New York State Education Department

# NEW YORK STATE MUSEUM

## 60th ANNUAL REPORT

1906

VOL. 1

REPORT OF THE DIRECTOR 1906

AND

APPENDIXES 1-4

TRANSMITTED TO THE LEGISLATURE JUNE 26, 1907



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NEW YORK STATE EDUCATION DEPARTMENT
1908

STATE OF NEW YORK

## EDUCATION DEPARTMENT

STATE OF NEW YORK

No. 68

# IN ASSEMBLY

JUNE 26, 1907

# 60th ANNUAL REPORT

OF THE

# NEW YORK STATE MUSEUM

*To the Legislature of the State of New York*

We have the honor to submit herewith, pursuant to law, as the 60th Annual Report of the New York State Museum, the report of the Director, including the reports of the State Geologist and State Paleontologist, and the reports of the State Entomologist and the State Botanist, with appendixes.

ST CLAIR MCKELWAY
*Vice Chancellor of the University*

ANDREW S. DRAPER
*Commissioner of Education*

# CONTENTS

## VOLUME 1

### Report of the Director 1906



### Appendixes 1-4

*Museum bulletins* 112, 114, 118, 109, 110, 116

CONTENTS

## VOLUME 2

### Appendix 5

*Museum bulletins* 107, 111, 115



## VOLUME 3

### Appendix 6

*Museum bulletins* 108, 113, 117



## VOLUME 4

### Appendix 7

*Museum memoir* 9



## VOLUME 5

### Appendix 7 (*continued*)

*Museum memoir* 10

*New York State Education Department*
*Science Division, December* 20, 1906

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

SIR: I have the honor to transmit herewith my Third Annual Report as Director of the Science Division, for publication as the introductory portion of the 60th Annual Report of the State Museum.

Very respectfully
JOHN M. CLARKE
*Director*

*State of New York*
**Education Department**
COMMISSIONER'S ROOM

*Approved for publication this 22d day of December* 1906

A. S. Draper
*Commissioner of Education*

New York State Education Department

# New York State Museum

John M. Clarke, Director

## THIRD REPORT OF THE DIRECTOR OF THE SCIENCE DIVISION

INCLUDING THE

60th REPORT OF THE STATE MUSEUM

THE

26th REPORT OF THE STATE GEOLOGIST

AND THE

REPORT OF THE STATE PALEONTOLOGIST FOR 1906

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## REPORT OF THE DIRECTOR 1906

### INTRODUCTION

This is a report on all the scientific activities under the charge of the Education Department and the Regents of the University, as they have progressed during the fiscal year 1905–6. It constitutes the 60th annual report on the State Museum and is introductory to all the scientific memoirs, bulletins and other publications issued from this office during the year mentioned.

Under the action of the Regents of the University (April 26, 1904) the work of the Science Division is "under the immediate supervision of the Commissioner of Education," and the advisory committee of the Board of Regents of the University having the affairs of this division in charge are the Honorables: T. Guilford Smith LL.D., Buffalo; Daniel Beach LL.D., Watkins; Lucian L. Shedden LL. B., Plattsburg.

The subjects to be presented in this report are considered under the following chapters:

I Condition of the scientific collections

II Report on the Geological Survey, including the work of the State Geologist and Paleontologist, of the Mineralogist and that in Industrial Geology

III Report of the State Botanist

IV Report of the State Entomologist

V Report on the Zoology section

VI Report on the Archeology section

VII Publications of the year

VIII Staff of the Science Division and State Museum

IX Accessions to the collections

X Appendixes: *A* New entries on the general locality record of the paleontological collections; *B* Additions to the catalogue of types of paleozoic fossils

XI Appendixes (to be included in subsequent volumes); all the scientific publications of the year.

## I

## CONDITION OF THE SCIENTIFIC COLLECTIONS CONSTITUTING THE STATE MUSEUM

Each year brings new problems and the efforts at their solution important acquisitions to the collections. The past year, planned for the continued prosecution of work already under way in many lines, has brought to light some extraordinary developments leading to unusual activity both in field and office. These are specially referred to in subsequent chapters. The disposition of the valuable scientific materials accruing therefrom has become a serious problem. In my report of last year reference was made to the incursion upon our collection rooms in the Geological Hall by the Commissioner of Agriculture and his large staff of assistants. The resulting situation, not to be avoided on account of the demands of public business, involved serious curtailment of space available for our use and necessitated the packing away of the entire collection of State minerals and closing to the public the exhibition in economic geology and some part of the collections in ornithology. This cramped and constrained condition applies to all our quarters in every department of our work and only the contemplation of new and ample space, the growing tangible hope of a building adapted to the importance and scope of

our work helps to palliate the existing situation and make our present embarrassments endurable.

The most telling event of the year in this division of the work of the State, that most fraught with gratification for the present and significance for our future development, is the action of the last Legislature in making the preliminary appropriations for a building to embrace and provide for the State Museum and its attendant offices. Our appeals to the Legislature for this end began more than 20 years ago, and for all this long time we have labored under constantly growing disadvantages and embarrassments. The event however obliterates past discomfort and reconciles us to the present condition which must perforce grow still more constrained until the relief arrives.

As a matter of record the present distribution of the scientific collections is here restated.

*A* **Geological Hall.** Here are the offices of the State Botanist with the herbarium, of the State Entomologist with the collections of insects, of the Assistant State Geologist, the Mineralogist and the Zoologist. These office quarters have unavoidably displaced a very considerable part of the collections, as the first two officials named were formerly located in the Capitol and the other offices were on the first floor and in the basement so far as they existed at all. Here are also the workrooms of the Archeologist and Taxidermist. There is an exhibition of zoologic material occupying the fourth or top floor, of rocks and fossils filling such part of the third floor as is not occupied for offices, and all the second floor; the collections in industrial geology and mineralogy and a considerable part of those in ornithology are now stored in the old lecture room. In the basement and cellar are stored in boxes all the collections which have won grand prizes and gold medals at the recent expositions at Buffalo and St Louis.

*B* **State Hall.** The offices of the Director, Geologist and Paleontologist and his staff are in this building, which also contains the most valuable part of the large paleontologic collections of the Museum. These are stored in several thousand drawers and boxes. In the basement is the extensive rock-cutting plant and machine shop. Within recent years three of these offices have been surrendered to the Corporation Tax Bureau and one basement room to the State Engineer.

*C* **Capitol.** The corridors on the fourth floor at the western end and the landing of the western stairway contain a series of cases filled with such part of the archeologic collections as can now

be displayed. Additional specimens pertaining to this collection are displayed in the State Library and many others are packed away for future exhibition.

*D* **Storage house** (McCredie malthouse). In this building are stored many hundreds of boxes and cases of scientific specimens of various kinds, some of which have not been opened in a half century, others containing the materials recently acquired which after being studied have had to be put away.

*E* **Flint Granite Co., Cemetery station.** Here are stored some very large slabs of fossils having a total weight of upwards of 20 tons.

*F* **Property of Joseph L. Verstrepen, north side of Delaware street between Swan and Dove streets, Albany.** Here are stored about 2 tons of slabs bearing fossil sponges from the Chemung group at Bath, N. Y.

It will be entirely evident from the foregoing statements that access to the scientific collections is now practically inhibited. Conditions permit little else than the opening of the material as it comes into the office from the field, unpacking, studying and repacking for storage, to the disadvantage of any one, student or visitor, who may desire to examine such collections.

This situation it is the hope of the present and the realization of the future to remedy.

These existing circumstances have entirely failed to impair the zeal for acquisition or the quality and quantity of accessions to the collections. The annual additions to the State Museum are very large. This year they have been exceptional in quality and volume. For the most part these, irrespective of quality, are for the time being under eclipse in the vaults of the storage house.

## II

## REPORT ON THE GEOLOGICAL SURVEY, INCLUDING THE WORK OF THE STATE GEOLOGIST AND PALEONTOLOGIST, OF THE MINERALOGIST AND THAT ON INDUSTRIAL GEOLOGY

### GEOLOGICAL SURVEY

### Areal geology

The plotting of the rock geology by quadrangles has proceeded as in the previous few years with reasonable celerity and substantial progress.

**Central and western New York.** For the sedimentary rock region of central and western New York the publication of the Buffalo, Penn Yan and Hammondsport sheets has been completed and the Rochester and Ontario Beach sheets, to be issued as one, are printing.

The maps of the Ovid, Genoa and Morrisville quadrangles have been perfected and drawn and the field work has been done on the Geneva, Auburn, Nunda and Portage sheets. Some progress was also made on the Skaneateles and Phelps quadrangles. With the exception of the Morrisville and the Rochester-Ontario Beach maps, this work has been executed by Mr Luther. Farther east Mr Whitnall has completed the Cazenovia sheet which lies between the Morrisville area and the Tully quadrangle which latter was issued two years ago.

The survey of the Syracuse quadrangle has been in charge of Prof. T. C. Hopkins who reports the work completed and the map ready for publication.

With the completion of these quadrangles, added to those already issued in recent years in the adjoining region, the Canandaigua, Naples, Watkins, Elmira, Salamanca and Olean quadrangles, we are able to present in detail the geological structure of an extensive area with an east-west length of 120 miles and reaching from Lake Ontario to the Pennsylvania line. This is a region largely of Devonic rocks developed in their most characteristic and typical American expression, hence we now have the entire thickness of this formation recorded in detail together with the variations east and west of the formational units and the paleontological contents. Included also in this area of close mapping are sections of the Upper Siluric in the Rochester and Syracuse regions and of the Lower Carbonic in the Olean and Salamanca districts.

**Schoharie and Cobleskill valleys.** A very detailed map of this classical region in the Paleozoic rocks of New York has been issued during the past year, prepared by Professor Grabau and published in connection with his bulletin on the *Geology and Paleontology of the Schoharie Valley.*

The history of New York geology may be said to begin with this region and nowhere in the State are the Paleozoic rocks crowded together in so great variety and so characteristic development, nor is any part of the State more inviting to the student of geology, yet until now no adequate map of the region has existed.

**Theresa quadrangle.** I last year reported the progress made by Professor Cushing in the mapping of this region. The region

is one where the early Cambric sediments overlapped the crystallines and have been scraped off therefrom in highly irregular fashion exposing the old rock floor, but leaving the sedimentary Potsdam sandstone in patches and outliers. The mapping here involves somewhat more cautious procedure than is required in the regions previously mentioned where it is known that the outcrops run in approximately east and west lines. The larger part of the Theresa quadrangle is occupied by the Paleozoic rocks but in the northeast portion the Potsdam sandstone is in the process of being stripped away from the underlying crystallines, thus affording opportunity for studying the topography of the ancient rock surface on which the Potsdam sediments were laid down. This old sea floor was of the ridge and valley type, a form derived from erosion before its partial submersion beneath the sea. The ridges trend northeast and have altitudes of 100′ to 200′ above the valleys. The Potsdam sandstone has a maximum thickness of 200′ over the old valleys but on the higher ridges it was never deposited at all.

The Precambric or crystalline rocks are the Granville series, recognized to be of sedimentary origin, and an amphibolite series, the latter badly cut into by a granite batholite.

The Granville sediments disclose two main groups, a thick and pure limestone formation and a formation of thinner beds consisting of sedimentary gneisses, quartzites and limestone. All are repeatedly cut by dikes of igneous rocks chiefly of granite.

The Potsdam sandstone has its usual quartzose character and is overlain by a thickness of about 100′ of thin bedded sandy dolomites with interstratified layers of coarse, brown and mottled sandstone. Both types of rock contain the characteristic brachiopod Lingulepis acuminata which is recognized as one of the index species of the Potsdam sandstone. The upper formation is, however, clearly differentiated from the typical Potsdam below and the Beekmantown limestone above and it is therefore being mapped as a separate formation.

The later and overlying limestone occurs in the southern portion of the quadrangle but the boundaries have not yet been fully determined.

**Long Lake quadrangle.** The survey of this area in the heart of the Adirondack mountains has been completed and the report and map are in course of publication.

**Valcour island.** In the report of last year there was reference to the progress made by Prof. G. H. Hudson in the survey of

Valcour island, Lake Champlain. It has been the purpose to make the study of this interesting isolated area more than a discrimination of its rock formations. Valcour island is a spot of singular attractiveness for its location and salubrity; it is equally inviting for the development and accessibility of its Lower Siluric rocks and fossils. The survey of this island is being carried out on a much larger scale than the uniform topographic maps, the contours being drawn at 1 foot intervals. These investigations have led to interesting paleontological discoveries which have furnished the basis of two papers by Mr Hudson already published in the Museum bulletins.

**Highlands of the Hudson.** Dr C. P. Berkey reports the completion of the areal survey of the crystalline rocks in the Tarrytown sheet and the extension of his investigations to the West Point sheet adjoining at the north. The region about Peekskill on the southern margin of the Highlands has proved so complicated structurally and so incompletely differentiated stratigraphically that it was found advisable to defer the continuation of the mapping until these problems could be solved. With this purpose in view the whole breadth of the Highlands has been examined, especially regions of critical importance close to the Hudson river.

The following statements summarize the best established conclusions from the investigations:

1 The oldest formation of the Highlands is a gneiss, provisionally designated the *Highland gneiss* and probably equivalent to the Fordham gneiss of the New York city district.

2 This gneiss is essentially a series of metamorphosed ancient sediments chiefly silicious, now appearing as granite gneisses, quartzite schists, mica schists with occasional interbedded limestones and serpentinous beds. The whole series is abundantly interjected with sheets, stringers and dikes of igneous origin of many varieties and different dates. The most abundant types are granites and pegmatitic granites which are occasionally intruded in such large bodies as to form some of the most prominent ridges or mountains of the region. Such masses are Storm King and Breakneck Ridge. The older igneous intrusions are themselves sheared and recrystallized into gneissic structure.

3 At some places the gneiss-schist passes conformably and gradually into a quartz-schist and even into a quartzite of no great thickness. This in turn is followed by a coarsely crystalline limestone of several hundred feet thickness and, allowing for its greater mobility

in the extreme folding it has undergone, seems to be essentially conformable also to the underlying series. Conformably over this lies the great thickness of the mica schist which occurs abundantly in the region south of Peekskill to New York city. These are the equivalents of the Lowerre quartzite, Inwood limestone and Manhattan schist of former reports.

4 In other places, and commonly on the northern border of the Highlands and in the Peekskill creek valley a similar succession lies with striking unconformity on the tilted gneiss or as sometimes happens, is so faulted as to have obliterated the original relationship. The series at such places, above the unconformity from bottom to top is: a fine quartzite, 300′ to 600′, a fine grained banded limestone, about 1000′, overlain by a great but unknown thickness of shales, slates, phyllites and shaly sandstones. These series at the localities where their relationships are known are equivalents of the Cambric quartzites, Wappinger limestone and "Hudson River slates" of other reports relating to the district north of the Highlands.

5 It seems reasonable that these two types of occurrences represent two wholly different sedimentary groups, one much the older and together with the older gneiss, forming a Precambric group; the other forming a Cambric to Lower Siluric group; the two separated from each other by a time interval of unknown value. The region has been diligently searched for a satisfactory contact of the upper members of the two series with each other but thus far without success. All members of the older series are injected with igneous masses, on the contrary the upper series is nowhere cut by any kind of eruptive except by the Cortlandt series which is the latest type in the entire region.

6 There is a series of faults of great displacement bordering the Highland belt both on the north and south, in the vicinities of Cornwall on the north and Peekskill on the south. This has allowed movements of considerable areas as blocks and accounts for much of the abruptness of the change along the southern margin especially from later sediments to older gneiss. This faulting is later than Lower Siluric and was accompanied by the Cortlandt igneous activity. No later geological deposits occur in the district except the drift.

7 All the larger stream valleys were in preglacial time eroded below the sea level. Some are filled with 200′ to 300′ of glacial drift. It is more than 375′ to bed rock in the Hudson river opposite Storm King.

## Surficial geology

The field investigation of the glacial and postglacial geology of the State has been carried forward in the northern Hudson and Champlain valleys, in the Mohawk valley and in western New York. Most of this work is in direct continuation of operations already begun and in considerable measure reported. We have in press at this time reports by Professor Fairchild on the *Glacial Waters of the Erie Basin,* the *Drumlins of Central-Western New York,* and by Professor Woodworth on *Postglacial Faults in Eastern New York;* a further report by Professor Fairchild on the *Later Glacial Waters of Central New York* awaits publication.

**Schuylerville quadrangle.** Reference was made last year to the inauguration of a survey of this special district by Prof. J. B. Woodworth and this work has now progressed to its completion.

**Cobblestone Hill beaches.** This is a special investigation of a series of marine beaches in Clinton county executed by Professor Woodworth and now completed.

**Moraines of western New York.** The mapping of these features has been well advanced and will be prosecuted to completion by Professor Fairchild.

**Shore lines of Lake Iroquois, and Pleistocene geology west of the Adirondacks.** The examination and determination of these problems are in the charge of Professor Fairchild and are advancing with adequate despatch.

**Pleistocene phenomena of the Lower Mohawk valley.** Prof. A. P. Brigham has undertaken the mapping of the glacial deposits on the Amsterdam, Broadalbin, Gloversville and Fonda quadrangles.

Northville is near the north line of the district and Duanesburg and Sloansville are close to the southern boundary. Along the river the area extends from the Noses, to about Rotterdam Junction. Thus the southern Adirondacks, the Mohawk valley and the northern parts of the Catskill Plateau are represented, and the study of the area will relate itself closely to the work accomplished by Prof. J. B. Woodworth and others in the Hudson valley.

Most of the time at disposal has been given to mapping in detail and the formations have been thus delineated over the greater part of the Broadalbin quadrangle with beginnings on the three remaining quadrangles of the group.

Marked diversity appears in the thickness of the drift mantle. Thus the deposits are unusually heavy in the immediate valley of

the Mohawk and southward to the escarpment of the sandstones rising above Minaville and Glen. Massive drift also extends from Galway and Hagadorns Mills westward by Broadalbin, and beyond Johnstown and Gloversville. South of this belt and north of the Mohawk river is a region of very sparse drift, due perhaps in large part to the Tribes Hill and Hoffman faults, and the consequent exposure of the uplifted areas to glacial abrasion.

It has been noted in earlier writings that a Mohawk glacier moved westward or up the valley. Considerable new evidence in this direction has been found. The topography is "linear" and the flutings have a conspicuous east by west trend. This appears on the contoured maps and even more strongly in the field. Within the field of the Mohawk glacier about a dozen new localities of striae were found. These range through the entire field north and south of the river and have an average westward trend. Several run n. 80° w. or 10° north of west. A few show trends south of west. Doubtless the western and southern limits of this lobe will be found outside of the quadrangles named.

A separate movement is indicated for the Sacandaga valley about Northville and south and southwestward to Broadalbin and Gloversville. East and west of this much reduced area are bold spurs of the Adirondack Precambric, extending southward and forming the boundaries of what we may call the Sacandaga glacier. Here the movement was southward at Northville, becoming southwestward about Mayfield and there apparently confluent with the westward movement of the Mohawk lobe about Gloversville. The striae and drumlinoid hills confirm this conclusion as well as the trend of a considerable number of true drumlins found in the region about Gloversville and Johnstown.

From a point to the eastward of Hagadorns Mills, a belt of sand hills extends westward and has thus far been traced for a distance of 25 miles to a point at the summit of the Noses fault escarpment, west of Gloversville. Broadalbin is at the south base of this sand belt and the city of Gloversville is mainly built upon it. It is interpreted with reservation, as an interlobate moraine of the Mohawk and Sacandaga glacial lobes. Other groups of sand hills appear along the Sacandaga above Northville, below Edinburg and on the spur inclosed by the Sacandaga north of Northampton. These belong to the recession of the Sacandaga glacier. In some instances the sands are kames and a number of sand plains occur which were accumulated within retaining walls of ice. Parts

of the belt are almost a desert waste and the winds to some extent have shifted the materials and obscured the glacial topography by the formation of dunes.

Lake waters are indicated for the Mohawk valley up to the altitude of 460 feet approximate. The deposits in this body of standing water are conspicuous at Amsterdam, about Auriesville and westward from Fonda. The shore lines will be traced and the genetic relations made a subject for further inquiry.

Lake waters also occupied the Sacandaga valley from Northville southward over the great Vly which lies between Northampton and Mayfield. This body of water was apparently a glacial lake which was reduced to conditions approximating those of the present time, by the melting of the ice from the lower Sacandaga valley. Northville is at the head of an extensive delta whose deposits were built into these waters.

It is held with confidence in view of the season's studies, that the preglacial course of the Sacandaga was southward into the Mohawk near Fonda. In brief the reasons for this view are as follows. It was the natural course in view of the rapid base leveling of the sedimentary areas south of Northville, as compared with the resistant Adirondack spurs on the east and west. The drift above Gloversville and Johnstown is sufficiently heavy to form a barrier to the present issue of the waters in that direction. The rock floor of the Sacandaga is considerably lower at Northville than at Conklingville, and at the latter point the Sacandaga is constricted to a narrow gorge, within which the bed rock appears in the stream, conditions strongly suggesting that this was an ancient col from which short streams flowed toward the Sacandaga at Northampton and the Hudson at Hadley.

A hasty examination of the conditions of the Hudson about Hadley and Corinth leads to the belief that the Hudson suffered a similar diversion from the valley about Greenfield, to the present course toward Glens Falls. This hypothesis will be tested in the coming season, when it is hoped to complete the mapping of the four quadrangles, affording a basis for a report in detail.

## Industrial geology

**Mines and quarries.** The second of the series of annual bulletins on the mineral industry of New York State was prepared by the Assistant State Geologist and published in June of the current year. The series was inaugurated for the purpose of placing before

the public in a timely manner authentic information as to the distribution and economic utilization of our mineral resources. In addition to many details of new discoveries and developments, the recent issue contains a much fuller discussion of certain subjects than was given in the preceding volume. The statistics of production, likewise, have been amended, with the inclusion of returns for 1905. As a supplement to the text a list has been prepared of the individuals or firms which are actively engaged in mining and quarry operations.

There are about 30 different mineral materials occurring in the State, that have importance as a basis for commercial production, and the combined value of their product, according to the reports received last year, may be placed approximately at $35,000,000. This sum represents only a part of the actual wealth that accrues annually to the State from the exploitation of its mineral resources, since the first products upon which the valuation is calculated are susceptible of further elaboration and thus lend support to many manufacturing industries.

**Iron ores.** The investigation of the iron ore deposits has received such attention as could be commanded. The field work in the Adirondack region has been carried into Essex, Washington and St Lawrence counties and the portion of Clinton county not covered during the season of 1905. Nearly all of the mines in this section have now been visited and a large amount of material assembled for office study. It may be noted that exploration in the iron mines of this region has been active during the year, affording exceptional opportunities for collection of data on the geology and occurrence of the ores. Acknowledgment is due to those engaged in such enterprises for much valuable assistance.

One of the more important districts which has been under investigation is that of Hammondville, Essex co. These mines were very productive at one time and were prominent, as well, for the fine quality of their product. They were worked up to about 12 years ago when operations were discontinued owing to depressed market conditions. The deposits are now being tested by the diamond drill with the view to their reopening, should the results be of sufficiently encouraging character. The ore is distributed in a number of bodies, varying from small bands or lenses to masses of notable size, within an acid gneiss which resembles the rock associated with the Mineville magnetites. An examination of the district has shown that the area occupied by the ore-bearing gneiss

is much more limited than had been supposed. The formations in the vicinity have been traced with considerable care and the results will be embodied in the forthcoming report.

A small group of mines, including the Long Pond, Skiff and Schofield openings, on Skiff mountain south of Hammondville, were also visited.

Near Crown Point and extending south toward Ticonderoga there are several deposits that have been worked at one time or another, but are now inoperative. Some of the principal ones are the Breed, Kent, Butler and Vineyard. The country rock is a basic variety of gneiss, usually banded and showing indubitable evidence of sedimentary derivation. The ores are generally rich, though there is more or less pyrite present as is frequently the case with ores occurring in rocks of this character.

The Mt Defiance mine, just south of Fort Ticonderoga affords an interesting, if not unique, type of deposit among the iron mines of this section. The ore is a massive hematite filling a vertical fissure in gneiss. The walls on either side are crushed evidently by the movement which has produced the opening. Mixed with the ore there is a considerable amount of quartz and calcite. The occurrence is clearly to be ascribed to the circulation of underground waters. The reopening of the mine has been under consideration recently and an adit was started near the base of the mountain to afford access to the old workings, but has since been abandoned.

The Fort Ann, Potter and Mt Hope deposits in Washington county and the ore bodies in the vicinity of Dannemora, Clinton co., were included in the field work of the season.

On the western side of the Adirondacks, in St Lawrence county, are the Benson mines which are remarkable for their large size. Though at present closed down, they have been under energetic exploitation at different times during the last 20 years, and there is a possibility of restarting operations on a still larger scale. The deposits outcrop along the side of a ridge, offering unusual facilities for economical exploitation by open cast methods. The ore is magnetite distributed through a gangue of feldspar and quartz with an average tenor of about 35 per cent iron. By crushing and separation as was practised formerly a concentrate carrying above 60 per cent can be made.

Several other magnetite deposits occur in this region, notably at Jayville, Fine and Clifton, and have been examined. They are

much like the ore bodies found near Crown Point that have been mentioned as included in metamorphosed sediments, the ore being relatively rich but pyritic.

An undertaking which may lead to important developments for the iron-mining industry has been initiated at Lake Sanford with reference to the great bodies of titaniferous magnetites in that vicinity. Situated in one of the remotest and wildest portions of the Adirondacks, the locality was sought out in the early part of the last century by pioneer iron workers who were attracted by the reported richness of the ore and the ease with which it could be obtained. Mining was begun soon after 1830. The ore was smelted in a small charcoal furnace and the product hauled by wagon to Lake Champlain for shipment. Apparently the first attempts at making iron from the unusual ore were successful, for operations were afterward expanded by the erection of a larger furnace and a settlement of some size grew up about the works. In 1858 the industry was abruptly discontinued owing to causes that have been variously explained. Since that time practically nothing has been done toward resumption of activity until the transfer of ownership, which took place recently, brought the property into the hands of experienced mining men. During the past summer a large amount of exploratory work with the diamond drill has been accomplished and the results have gone ahead of expectations, showing that previous estimates of the magnitude of the deposits must be greatly enlarged. The Lake Sanford ore body in particular is of enormous size; the available resources within a short distance from the surface exploitable by quarry methods, run up into the millions of tons. This ore carries from 50 to over 60 per cent iron and except for occasional stringers is quite free from rock. Rich magnetite has been uncovered also in a new locality north of Calamity brook. The one drawback to the utilization of the ore is the presence of titanium, which characterizes deposits of this type associated with gabbros and anorthosites. It is hoped, however, that some solution of the difficulty will be found whereby the ore will be marketable. Experiments with magnetic separation are said to have been successful in making a product with a low titanium content, and it is possible that a portion of the crude material might be used in mixture with ores from other districts. The issue of the present venture is awaited with interest.

Field work was started in the hematite district of St Lawrence and Jefferson counties. In order to obtain a suitable base on which

to plot the geology of the mines it has been necessary to prepare a sketch map on a larger scale than any that has been published. The department cooperated in this work with the representatives of a mining company who had purposed making the survey for private use, and was thus able to secure the map at inconsiderable expense and labor. The general facts relating to geology have already been placed on the map, but owing to the lateness of the season, it was found impracticable to complete the investigation.

The ores of this district are red and specular hematites, with an average iron content ranging from 40 to 65 per cent. A number of mines have been worked at one time or another and their output amounts to a very respectable total. The principal openings lie within an area from ¼ mile to a mile or more in width, which begins a short distance from Antwerp, Jefferson co., and extends northeasterly into the town of Gouverneur, St Lawrence co., a distance of about 5 miles. The marked linear distribution observable in the deposits is conditioned by the occurrence of the associated rocks in belts having a northeast-southwest strike. The important geologic formations comprise crystalline limestones, gneiss and thinly foliated schist, all of which have been upturned and probably closely interfolded, and which are capped at times by small areas of Potsdam sandstone with a strong unconformity at the base. Both the schist and limestone, and possibly the gneiss also, belong to a series of Precambric sediments that has been thoroughly metamorphosed and subjected to erosive influences through a long period previous to the deposition of the sandstone. The schist seems to have had originally the character of a bituminous shale, for it contains much graphite evenly distributed throughout the layers, indicating an organic derivation for the mineral. There is some diversity in the occurrence of the individual ore bodies, though from a general standpoint, and particularly with respect to their origin, they are all closely related. This difference in the geologic surroundings is no doubt accountable for the many views that have been expressed by geologists who have studied them. At some localities where the Potsdam is present, the ores are gathered along the contacts with the underlying limestone or schist, and in such cases there is often apparent a transition phase with graduation upward into the sandstone. This relation has been adduced in support of the theory that the ores are sedimentary, or at least have been derived from the sandstone. The relation is not constant, however, for in some mines the bodies of ore occur wholly

within the schists and the sandstone is entirely absent. Again the existence of a peculiar rock resembling serpentine, in masses not unlike dikes has been emphasized by writers who would refer the ores to igneous sources, as it is known that serpentine generally owes its origin to alteration of basic intrusives. Still another explanation is based on the fact that bands of pyritic schist are found in close association with the deposits and involve the oxidation of the pyrite and replacement of the limestone by the resulting iron oxids. While the present work has not been carried sufficiently far to warrant, as yet, a statement of the results in reference to the relations and origin of the ores, it is believed that a comprehensive investigation of the field, which has never before been undertaken, will throw much new light on these interesting problems.

Field work on the Clinton hematite ores was undertaken by the Assistant in Economic Geology for the purpose of ascertaining more definitely the stratigraphic relations, areal distribution, variations in character and thickness of the deposits on different meridional sections along the outcrop.

In passing eastward from Niagara Falls, the Clinton ore is first encountered near Rochester where the bed has a thickness of 14 inches. The ore here rests on beds of green shale 24 feet thick, while the overlying formation is a hard limestone 14 feet in thickness. The same stratigraphic relations are found at Ontario, Wayne co., 17 miles east of Rochester, where the ore measures 22 inches. Mining operations have been conducted in that vicinity for many years and the line of workings extends about 5 miles, from a little north of Ontario village westward to Union Hill, near the Wayne-Monroe county line. The Furnaceville Iron Co. is now engaged in mining ore on its property just north of Ontario Center. The methods employed by the company, which consist briefly in the excavation of long trenches parallel to the line of outcrop, are economical and well adapted to the work. About 20 feet of soil and rock have to be removed before taking out the ore, steam shovels and derricks being used for the purpose.

The Clinton ore was formerly mined near Wolcott, 25 miles east of Ontario. A furnace was in blast here as early as 1834, but has not been in operation since 1879. The ore was obtained at a locality 4 miles east of the furnace where the bed is said to be 30 inches thick, with 20 feet of overburden. The mines are now inaccessible. Some ore was obtained also along Wolcott creek just below the furnace. The bed is here 14 inches thick, but as it lies

immediately beneath the surface soil a portion, no doubt, has been eroded away, and a thicker stratum could be secured in adjacent localities where the overlying rocks are still in place. The stratigraphic relations of the ore at Wolcott are not entirely clear. According to Hall the ore does not lie in the same horizon with the bed at Ontario, but at a higher one, and it has been suggested that two beds may be present though admittedly the two are not found at any one place. The conditions so far as they have been ascertained indicate, however, the existence of a single bed which corresponds stratigraphically to the ore at Ontario.

At Sterling Station, Cayuga co., 10 miles northeast of Wolcott, the Fairhaven Iron Co. has recently begun mining the Clinton ore. The opening is close to the former workings of the Furnaceville Co. A section of the strata, made some distance back of the outcrop, shows the ore to be 36 inches thick, with overlying limestone 18 to 24 inches, shale 55 feet and soil 10 feet.

From Sterling Station, the outcrop of the Clinton ore follows a direction somewhat south of east, approximately in the latitude of Oneida lake, but it can not be accurately delineated. For an interval of 55 miles there are no openings, the next being near Verona village where some mining was done in former years. The bed here lies close to the surface and the region is quite flat.

At Clinton, the type section of the formation, the ore outcrops on both sides of the Oriskany valley. The Franklin Iron Manufacturing Co. and C. A. Borst have mines on the east side of the valley which are now active. The principal bed and the only one at present worked is about 30 inches thick, of oolitic character. A lower bed from 6 inches to 1 foot thick separated from the upper by 2 feet of shale is sometimes present, and a nonoolitic bed, 5 feet thick, occurs 22 feet above the main bed with intervening limestones and shales. The Franklin Iron Co. smelts its product in a local furnace. The remaining output from this locality is sold to manufacturers of mineral paint.

From Clinton the ore can be traced eastward to the Sauquoit valley and has been worked at many points along the outcrop. The most easterly locality where mining has been carried on is near Washington Mills, directly south of Utica. The ore can be followed several miles farther in that direction, but it does not appear in sufficient strength to repay mining operations. In some of the eastern sections, it occurs at horizons higher than the beds at Clinton. A fine grained sandstone from 12 to 15 feet thick and carrying about 10 per cent iron is found in Herkimer county.

From Ontario on the west, to Clinton on the east, the bounds of the outcrop of the ore beds that have workable dimensions, the distance is 120 miles. If an average thickness of 20 inches is used as a basis for calculation, the quantity of ore available in each mile of outcrop and an equal distance on the dip amounts in round figures to 5,000,000 long tons. While there has not been sufficient exploration as yet to establish the continuity or the uniformity of the beds between many widely separated localities along the outcrop, yet no doubt can exist that the resources of the Clinton formation are enormous. Considering the remarkable expansion which the iron and steel industries have undergone recently, it seems not unlikely that before long these resources will be brought into more extensive utilization than has obtained at any period of the past.

It is now of immediate importance that provision be made by the Legislature for the proper estimate under the supervision of the State Geologist of the volume and quality of this great ore body. The elements of uncertainty which must be eliminated before operations for production can be intelligently begun are chiefly two: (1) the possibility of variation in thickness of this ore deposit along the dip; (2) local variations in the quality of the ore. The dip of the ore bed and adjoining strata is slight, probably not in excess of an average of 50 feet to the mile, and due south, without perceptible variations east and west. It is not possible to determine at the outcrop whether the ore body will maintain its thickness, increase or diminish in and downward. Assuming that the underground condition is as favorable as the surface, mining for a mile in along the easy slope of the strata is entirely practicable. In order to ascertain the possibility of permanence or variation it is necessary to drill through the overburden at various points south of the line of outcrop. This procedure will serve to indicate favorable points for the sinking of shafts and to determine the thickness of the soil mantle which lies heavy over much of the region involved. Such borings should traverse the field in east and west series, one at a half mile from the outcrop, the other a mile therefrom and be placed at alternating intervals of not less than 5 miles. These determinations by boring must be supplemented by assays of the ore samples obtained at each boring or so far as that may be necessary.

Assistance will be asked from the Legislature to carry out these operations.

**Sandstones.** The investigation of the sandstones has been continued and the field work has been carried into the region represent-

ing the Devonic rocks. This area covers approximately one third of the entire area of the State and quarries have been opened in all of the 25 counties of this area. The sandstone quarried is almost exclusively that which in the trade is known as "bluestone." The quarries opened in this district exceed 400 in number, the larger proportion being in the four counties of Ulster, Sullivan, Greene and Delaware.

The area producing bluestone may be conveniently divided into three districts as follows: the Hudson river district, comprising Ulster, Greene and Albany counties; the Delaware river district, embracing Sullivan, Delaware and Broome counties; and the remaining district comprising the counties of central and western New York, of which Chenango and Wyoming are the most important.

In the Hudson river district, the Devonic rocks are represented by areas of coarse sedimentation extending from the Hamilton to the Catskill formation, and quarries are operated in all the formations. Many of the quarries are located on the steep sides of the foothills or on the slopes of the southern and eastern sides of the Catskills. In the quarries thus located the overburden soon becomes so great that the quarry can not be worked far into the ridge. This disadvantage is, however, partly offset by working along the edge of the outcrop thus giving a long working face to the quarry. The quarries are located from 3 to 10 miles from the Hudson river. The product is hauled by teams to docks along the river, where it is shipped by water to various points. The product of the quarries along the Ulster and Delaware is brought to Rondout by this railroad. The principal shipping stations are Catskill, Malden, Saugerties, Glasco and Rondout. A mill for dressing the stone is located at Rondout and the stone treated here is not only from the vicinity of Rondout, but from points farther up the river as well. As a rule the producers are small ones who sell their product to dealers having docks along the Hudson river.

In the Delaware river district there has been increased activity in the quarrying business during the past year. The valley of the Delaware is here a narrow one and the quarries are located on the steep hills rising from the river valley. The roads from the quarries to the railroad are in nearly every case so constructed as to be down grade or on the level all the way from the quarry. As a rule, the quarries are larger than those of the Hudson river district and the equipment is better. The industry along the Delaware

river, which here marks the boundary line of the State, is intimately connected with that of Pennsylvania. At Parkers Glen, in Pike county, Pa., there is a mill for dressing stone and the rough material is supplied by both states. The quarries are located from 2 to 8 miles from the railroad and the chief shipping points along the Delaware in New York are Pond Eddy, Narrowsburg, Cochecton, Callicoon, Hankins, Long Eddy, Lordville, Hancock, Hale Eddy, and Deposit. The product from the quarries along the Delaware, as far north as Hancock, is all shipped by the Erie Railroad. Along the east branch of the Delaware river and Beaver creek, there are a number of quarries located on the line of the Ontario and Western Railroad. The chief shipping stations are Cadosia, Tylers switch, Fishs Eddy, East Branch, Trout Brook, Cook Falls, Roscoe and Livingston Manor. A mill for the treatment of the quarry product is located at Tylers switch. A new railroad is in course of construction from East Branch along the east branch of the Delaware river. As the stone is of good quality a number of operators are contemplating opening quarries along the line of this railroad.

North from Cadosia the quarries in central Delaware county were visited. The principal quarries here are located in the vicinity of Walton. Westward from Walton is the Susquehanna valley. No large amount of bluestone is produced here. The quarries which are in operation are in the vicinity of Oneonta.

West of the Susquehanna is the Chenango valley. The principal quarries here are located at Oxford and Norwich. The large quarry at Coventry is no longer in operation. The output of the quarries at Oxford and Norwich is mostly building stone of which a large amount is annually produced. The mill formerly located at Oxford has, during the past season, been moved to Norwich where the conditions are economically more favorable for quarrying.

In western New York the most important quarries are located at Warsaw and Portageville in Wyoming county. Almost the entire product of these quarries is sold for building material. The rock of these quarries is softer than in eastern New York and channeling machines are used to advantage.

In addition to the above quarries in western New York, a number were visited in the vicinity of Cayuga and Seneca lakes. A line of quarries in the Cashaqua division of the Portage extends from Ovid Center to Taughannock Falls. None of them is in steady operation at present. One quarry is being worked at Kings Ferry on Cayuga lake. The quarries at Ithaca were also visited. The

production here is mostly for local use. These quarries are in the Ithaca formation and those at Oxford and Norwich are of the Oneonta horizon. A brief visit was made to the quarries at Elmira. The quarries just to the east of Elmira, at Horseheads and at Pine Valley are in the High Point sandstone, one of the higher divisions of the Portage-Chemung. Those at Warsaw and Portageville also belong to the High Point or Portage sandstones. Quarries in the Chemung formation have been opened to the south of Elmira and in Allegany, Cattaraugus and Chautauqua counties, but they have not been examined in detail.

## MINERALOGY

The research work in mineralogy during the past season has been confined principally to the crystallography and genesis of New York occurrences of minerals, the results of which have been incorporated in a paper now in press on the minerals of Lyon Mountain, N. Y. This investigation attacks the problem of the conditions affecting the deposition of calcite as expressed by the crystal habit. Some interesting conclusions were reached which confirmed the results obtained in a previous paper on the calcite of Union Springs.[1] Three new crystal forms are added to the list for calcite, as well as some highly interesting combinations and groupings. Some interesting twin crystals are described and figured under albite and some rare and interesting combinations under stilbite, titanite and apatite.

The curatorial work of the section has been much reduced through the abandonment of the exhibited mineral collection last December.

The work of collecting new material both for research study and for an enlarged and improved mineral collection has progressed with gratifying results. A fine series of minerals from the Sterling mine, Antwerp, was added to the already good collection from this locality. These included two specimens showing garnierite associated with millerite, and four specimens of goethite, both of which species are new from this locality. The goethite occurs as radiating tufts of light brown crystals like fine camel's-hair brushes. These are found on the surface of quartz and dolomite which line the cavities in the red hematite.

A series of 45 specimens of zircon in quartz and oligoclase was collected from a reopening of the old locality at Mineville. These equal in size and development the zircon crystals formerly obtained from this locality.

[1] N. Y. State Mus. Bul. 98.

A new locality for brookite was found by Mr C. A. Hartnagel in the limestone exposure at Indian Ladder, Albany co., two specimens being obtained as the result of a careful search. These occur embedded in calcite, differing in this respect from the Ellenville occurrence, to which, in other respects, they bear a marked resemblance. The crystals are very small, the larger measuring 1 mm in length.

A hitherto unnoted locality for tourmalin in the vicinity of Fort Ann was visited and several specimens obtained. The largest of these is a broken black crystal embedded in quartz and measuring 30 cm in length and 20 cm in diameter. Although showing no termination, it is well developed in the prismatic zone and shows the typical cross-section for tourmalin. A smaller specimen measuring 8 cm in length and 10 cm in diameter shows several well defined planes of the termination.

Some large orthoclase phenocrysts were obtained from a pegmatite exposure 1¾ miles northwest of Crown Point Center, Essex co. They occur in a coarsely crystalized matrix of quartz and orthoclase and show well defined crystal outlines. The largest of these phenocrysts measures 21 by 6 cm.

A number of large and well developed crystals of calcite were collected from the old eupychroite deposits 1 mile south of Crown Point. The calcite from this locality crystallizes in twinned rhombohedrons of the form R (10$\bar{1}$1) the largest of which measures 7.5 cm on edge. In the twinning habit they resemble the calcite from Rossie and other St Lawrence county localities, the twinning plane being parallel projections observed on the rhombohedral faces proved to be the incipient development of a twinning parallel to a hypothetic plane — ½ R. The crystals which are in general clear and colorless are in many instances thickly coated with stalactitic calcite.

A fine series of 140 calcite specimens was collected by the State Geologist from Percé rock, Gaspé, Can. These are clear to milky white in color and are superficially colored in many instances by a thin coating of a flesh-colored to red deposit of iron oxid derived from hematite. Barite and fluorite also occur associated with the calcite. The occurrence which presents some interesting crystallographic combinations, may be made the subject of a more detailed description.

The attention of the Assistant State Geologist was recently directed to the occurrence of fine calcite crystals in a limestone quarry

in Lewis county. The quarry is on the eastern slope of a ridge of dolomitic limestone extending northeast and southwest, the exposed face rising to a hight of about 35 feet. At a hight of approximately 20 feet from the base of this exposed face, the limestone has been hollowed out to form an irregular cavern, the wall, roof and floor of which were covered with calcite crystals, some of enormous size. At the time of the visit a portion of the walls of this cave had been removed in the operation of quarrying the limestone. Access to the cave was gained through an opening about 4 feet in diameter. Inside this opening the cavity expands to a cross-section of about 10 feet in width by 5 feet in hight, running back for a distance of some 20 feet when it suddenly contracts to a small passage about 4 feet in cross-section, rather winding, but extending downward in a general direction for a distance of about 20 feet, gradually narrowing to a size which rendered it impossible of access.

Many of the largest crystals were found in the outer portion of the cave, the roofs and walls of which were thickly covered with calcite crystals of all sizes. Fewer and smaller crystals were encountered in the inner cave where they were found mostly attached to the roof and sides.

The crystals are of unusual size, the largest taken out measures 3′ 7″ by 3′ 1½″ by 1′ 6″ and weighs approximately 1000 pounds.[1] A number of smaller crystals ranging in weight from 100 to 500 pounds were obtained, besides several large slabs covered with smaller crystals and a vast amount of small specimens representing single crystals and groups. In all about 12 tons of material of exceptional beauty and interest were taken from this locality.

In habit the calcite crystals resemble those from Rossie, St Lawrence co. They show a strong tendency toward the formation of penetration twins parallel to a composition face OP which is present as a well developed plane. This twinning habit finds expression in deep reentrant angles or "channels," well shown in the adjoining plate and produced by corresponding planes of R ($10\bar{1}1$) in twinned position.

On a number of crystals repeated twinning according to this law was noted; in one instance as many as four repetitions of the twinning habit being observed. The abnormal development of the basal plane produces a tabular aspect quite characteristic of the occurrence. The lateral edges of the primitive rhombohedron are modi-

[1] The largest calcite crystal of which a record is accessible is one from Eskifjördhr, Iceland, at present in the British Museum. It measures 2′ 6″ by 1′ 6″.

fied by one or more scalenohedrons. A more detailed description of these interesting crystals is reserved for a later paper. It suffices, however, to mention here that they present an interesting study both of crystal form and twinning habit.

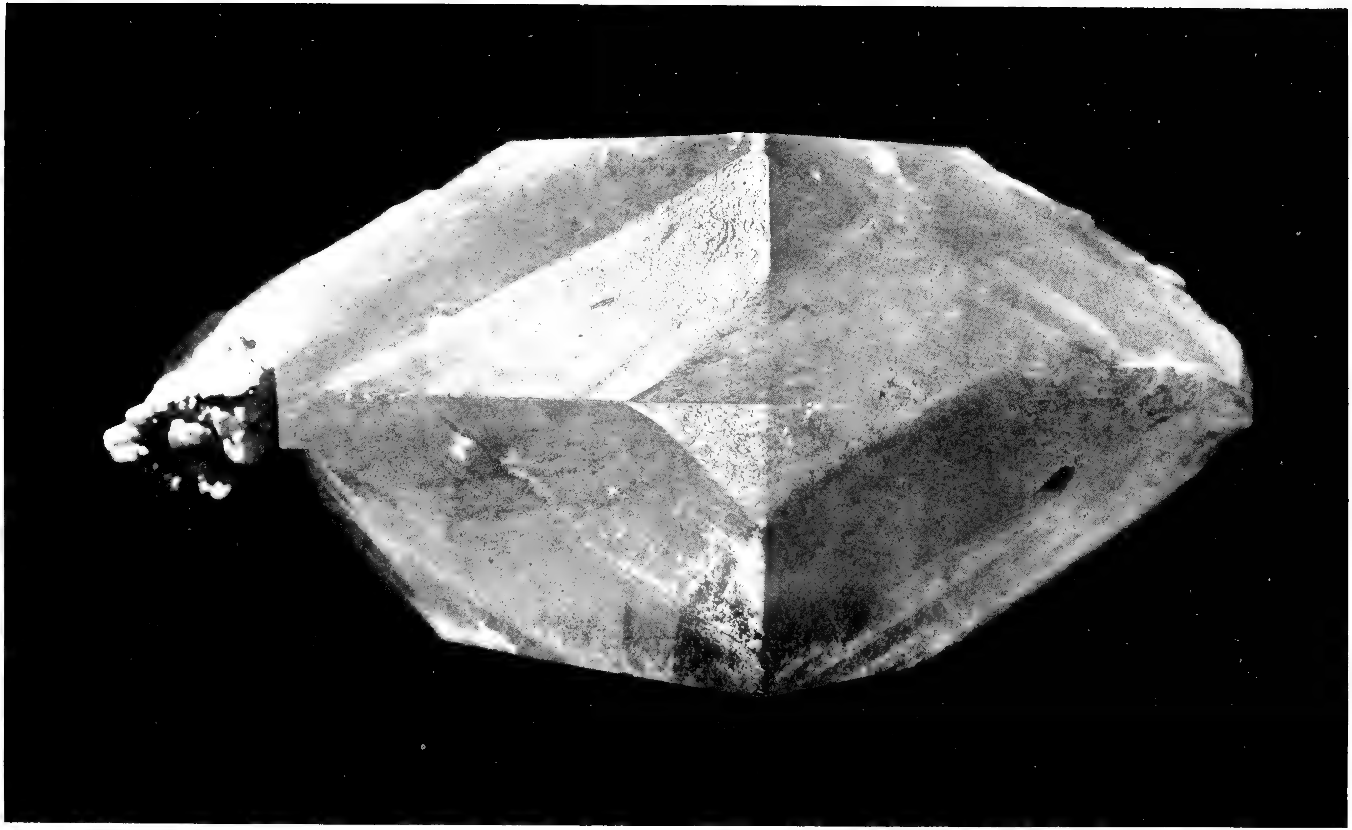
Many of the crystals which were found lying loose on the floor of the innermost portion of the cavern, were completely developed on all sides, showing no point of attachment. This fact which is sufficiently remarkable in crystals of this size may lead to some interesting speculations as to the manner of their production and the character of the crystallizing solution. Many of the largest crystals obtained from the outer cave were attached to the wall by a relatively small portion of their total surface so that it was possible to detach them by very little effort.

One of the most striking characters of these crystals is a delicate amethystine to pink color shown on a large majority of the specimens and which renders them singularly beautiful. The color appears to be irregularly distributed throughout the mass and shows deeper in the outer portions of the crystals. A tendency toward the concentration of color parallel to definite planes, notably the planes of cleavage is evident. Calcite crystals similar in color have recently been found in the Maybell mine at North Empire, Kan., and have been described by Sterrett,[1] who notes a similar lack of uniformity in the distribution of color. A dendritic deposit of pyrolusite observed on the termination of some of the small crystals from the outer cave indicates the derivation of the color from a minute percentage of manganese.

Secondary aragonite occurs as an incrustation of minute acicular crystals on some of the calcite representing an early generation. Some quartz was noted associated with the calcite of this stage. Although considerable stalactitic calcite was observed coating the surface of the large crystals, very little evidence of true stalactitic formation was to be found on the roof, walls and floor of the cavern. One slender stalactite which measured 12.8 cm in length and .5 cm in diameter was hollow for about one third of its length and was lined with crystallized calcite. This, together with the remarkable size of the calcite crystallization, points to a condition of extremely slow deposition of lime carbonate from a solution which must have remained undisturbed during the entire process of crystal deposition.

[1] Sterrett, D. B. A New Type of Calcite from the Joplin Mining District. Am. Jour. Sci. 1904. 18:73.

Plate 1



Crystal twinned parallel to the basal pinacoid. The composition plane shown in horizontal position

Plate 2

Group of crystals showing repeated twinning parallel to the basal pinacoid which appears in the illustration as a triangular face, the orientation of which corresponds to the two twin positions. The specimen well illustrates the characteristic deep "channels" produced by this law of twinning.

Plate 3

Group of crystals from wall of cavern, showing crust of secondary aragonite

The secondary twinning parallel to a hypothetic plane — ½ R which was previously noted in connection with the calcite from Crown Point, is developed to a marked degree in these crystals where it takes the form of parallel systems of sharp ridges protruding from the surfaces of the planes of both R and OP. On one crystal, the basal plane of which measures 15.6 cm on the bounding edges, one of these projections measures 4 cm in length and .5 cm in hight.

### EARTHQUAKE RECORDS

The seismograph installed in the basement of Geological Hall was placed in operation on March 10, 1906. It has furnished since that time a number of records which fully demonstrate its mechanical efficiency and its utility as an adjunct to the Museum's scientific equipment. Similar instruments have been in use for some time in Baltimore, Washington and Cheltenham, Md., but with these exceptions there are no other stations throughout the entire eastern section of the country where the investigation of seismic phenomena is proceeding at the present time. The records have an independent value as a measure of the character of earth tremors experienced in the region, while at the same time it is hoped they will contribute to the general advance of this line of work which is now receiving attention and support in many parts of the world.

The disturbances thus far registered at Albany have originated at remote points, none of them nearer than 2500 miles. In some cases, however, the wave motions traced by the instrument have been marked in their intensity, showing that local conditions are not unfavorable to their transmission. The fact that no earthquakes could be traced to near-by sources can not be regarded as indicative that the region lies without the bounds where sensible movements originate, for observations must be extended over a much longer period of time before any conclusions are warranted as to the occurrence and relative frequency of local readjustments such as give rise to earth tremors.

In explanation of the accompanying data relating to the seismograph records, it may be stated that the instrument used belongs to the horizontal pendulum type. It is an invention of Omori, the distinguished professor of seismology at the University of Tokio, and has been later improved by the makers, Messrs J. & A. Bosch, Strassburg, Germany. The instrument is placed on a concrete pier set into the ground to a depth of 3 feet and resting upon

undisturbed strata of clay. The distance to solid rock is not known. The pier is isolated from the ground by a narrow trench extending on all sides of the base of the foundation. There are two of the horizontal pendulums, one placed so that its axis lies east-west and the other north-south when at rest. They are supported by standards at one end while the outer extremities carry massive lead weights to which are engaged recording arms delicately pivoted and capable of adjustment so as to magnify or diminish at will the motion imparted to them. A multiplying ratio of 10 has been found to give good results at Albany. The recording arms register the movements by means of a needle, the point of which is in contact with a band of smoked paper wound around the outer surface of a drum. The drums are driven by clockwork at the uniform speed of one revolution an hour; their axes are cut with screw threads which cause them to move laterally as they revolve. An independent clock of better construction serves to record the shorter time intervals by opening an electric circuit which, passing through small magnets, causes an arm to press down upon the paper at the lapse of each minute. While in operation the instrument thus traces a continuous line in the form of a spiral on the smoked surface of the paper which also shows a series of dots regularly spaced representing the minute intervals. When the record is removed from the cylinder and stretched out in a plane, the spiral line becomes, of course, a series of parallel lines. In case any disturbance has occurred during the time of making the record, the line shows a series of wave motions of greater or less amplitude according to the violence of the disturbance.

The following constants are given in connection with the description of the records to facilitate comparison with those obtained at other stations. The latitude of Albany is n. 42° 39′ 6″ and the longitude w. 73° 45′ 18″. The foundation of the instrument is approximately 85 feet above sea level. Each pendulum including arm weighs 24 pounds 14 ounces or 11.283 kilograms, and the distance of center of gravity from rotating axis is 84.6 centimeters. The period of the pendulums (time required for a complete swing) during the time in which the instrument has been operated, has been found to vary, and it has been necessary to readjust them occasionally in order to obtain satisfactory results. Each readjustment involves a slight change in the period. It has been the aim to maintain a period of about 30 seconds and the variations have usually not exceeded five seconds.

RECORD OF EARTHQUAKES AT ALBANY

APRIL 10 TO OCTOBER 1, 1906

Standard time

| Date | Beginning preliminaries | Beginning principal part | Maximum | End | Max. amplitude | Multiplying ratio |
|---|---|---|---|---|---|---|
| | h. m. | h. m. | h. m. | h. m. | mm. | |
| Apr. 10..... | 4 29 p.m. | 4 41 | 4 41½ | 5 27 | 35 | 12 |
| Apr. 18..... | 8 21½ a.m. | 8 32½ | 8 35 | 11 5 | 65 | 10 |
| Apr. 18..... | 7 48 p.m. | ........ | ........ | 8 0 | ........ | 10 |
| Apr. 23..... | 4 28 a.m. | ........ | ........ | 4 35 | ........ | 10 |
| Aug. 16..... | 7 33 p.m. | 7 47 | 7 55 | 9 0 | 110 | 10 |
| Sept. 14..... | 11 37 a.m. | 12 5 | 12 10 | 1 13 | 25 | 10 |
| Sept. 28..... | 10 32 a.m. | 10 36 | ........ | 10 43 | 6 | 10 |

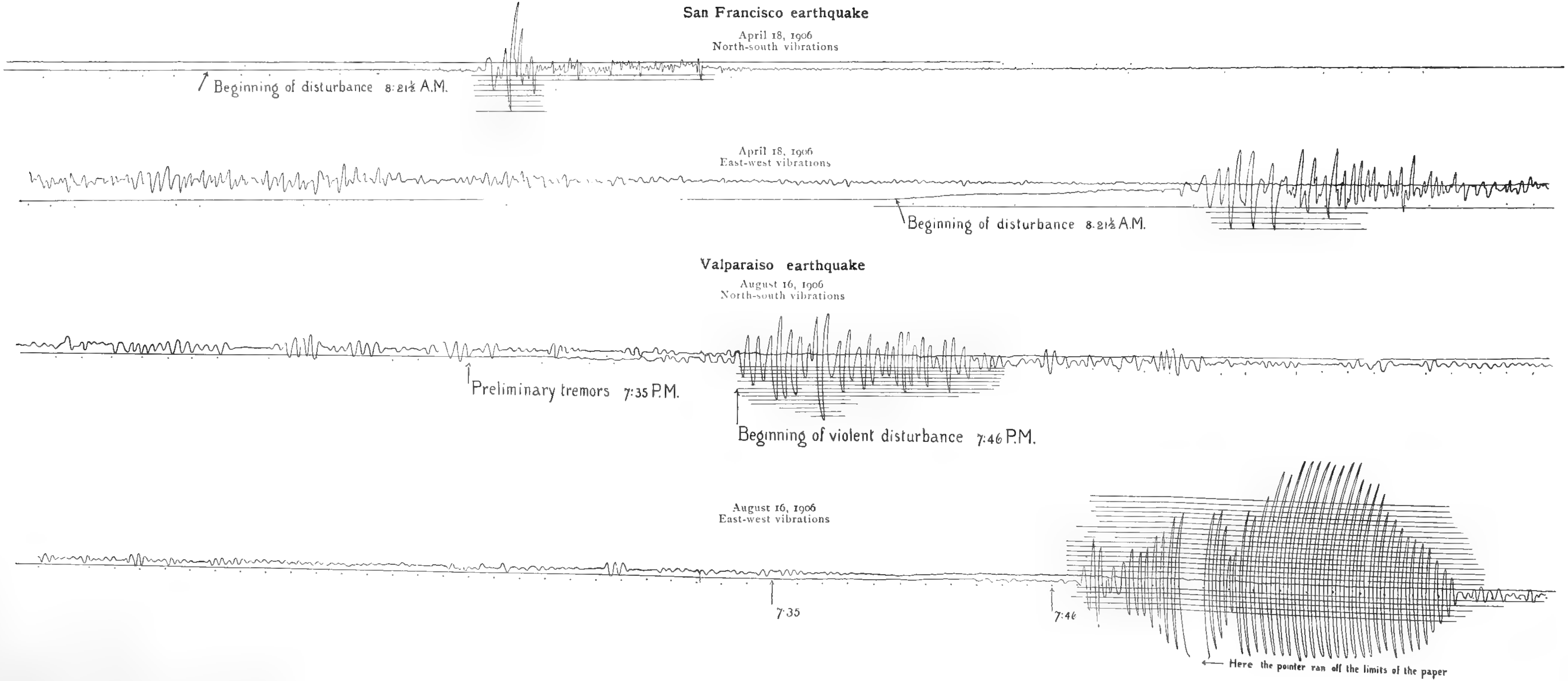
**April 10.** A small but well marked disturbance probably a preliminary to the earthquake of April 18 but possibly of Porto Rican origin. The larger vibrations were registered on the north-south pendulum, showing that they came from nearly an east or west direction. The period of the maximum waves was about 24 seconds. The disturbance was recorded also at the Washington and Baltimore stations.

**April 18.** This is the violent earthquake which originated on the Pacific coast, known as the San Francisco earthquake. It was registered at all the seismological stations in this country and at many places in Europe. The records obtained at Albany were excellent as the pendulums were in perfect working order at the time. A comparison of the two tracings shows the east-west component of the vibrations to be more pronounced, though a single long swing in the north-south component had the greatest amplitude, 65 mm as compared with a maximum of 48 mm in the former direction. The duration of the preliminary tremors covered nearly the same period as in the earthquake of April 10, indicating that both traveled approximately the same distance. The slight disturbance in the afternoon of April 18 was probably a reflex of the main shock.

**April 23.** Faint vibrations, but undoubtedly of seismic character. Main component was in an east-west direction.

**August 16.** This earthquake originated near Valparaiso, Chili, and was of even greater violence than that of April 18. The records obtained show the strongest vibrations of any disturbance registered thus far. The east-west component of the vibrations has the larger amplitude during the principal part of the disturbance, but the north-south component is more marked throughout the entire period. Near the beginning of the main vibrations, the pointer of the north-

SEISMOGRAMS



south pendulum swung off the paper and failed to register for a period of one second. The larger amplitude of the waves recorded by that pendulum may have been due to more sensitive adjustment.

**September 14.** A moderately strong movement recorded principally on the north-south pendulum. Origin is not known.

**September 28.** Slight disturbance, consisting of small waves separated by intervals of quiescence. Main component registered by the north-south pendulum.

## LIMESTONE CAVERNS OF EASTERN NEW YORK

In my report of last year attention was directed to the desirability of acquiring more exact evidence of the character and origin of the caverns which honeycomb the limestone region of the Helderberg plateau. There are many of these subterranean ways. They have long been known to the residents of the region and have been a source of popular interest partly because of the mysterious obscurity in which they have been veiled. Their geological importance lies chiefly in the relation of such underground passages to the topography and drainage of the country, for this class of caverns is elongated channels produced either by solution of the limestones or by subterranean erosion. The Helderberg plateau has been well adapted to their development because of its peculiar though simple geological structure. The region is one of continued succession of limestone beds varying in degree of purity and the strata in general are almost horizontal, whatever dip they have being to the south.

In the consolidation of these strata and by the strains they have undergone in their uplift they have been deeply cracked or parted without displacement of adjoining masses, by an intricate series of vertical joints which has made the floor of the region a mosaic of great limestone blocks. When solution or erosion has begun on this area, it naturally selects these lines of least resistance and the ultimate outcome is the production of cavernous channels in the rocks. It is thus entirely clear that essentially the whole system of underground channels stands in direct relation to and constitutes a part of the drainage system.

With the purpose of ascertaining these relations a party was organized during the past season, instructed to explore and survey all accessible caverns in this limestone plateau and to take note of their relations to geological structure, drainage, topography and organic contents. The work was prosecuted with vigor though it

was arduous and venturesome, involving risks to person which few would care to take. The results have been entirely satisfactory in solving the general problem above specified. Prof. John H. Cook was placed in charge of the work, having as assistants James F. Loughran, surveyor and Harry C. Cook, photographer.

The cave-bearing limestones of the Helderberg and Schoharie region are a part of a consecutive series which are geologically classified as follows from below upward:

At the bottom are the shales of the Hudson River complex, which in the eastern part of the region are unconformable with the beds above. Then follow in ascending order:

| | |
|---|---|
| Ontaric or Upper Siluric | Brayman shale<br>Cobleskill dolomite<br>Rondout dolomite<br>Manlius limestone |

| | |
|---|---|
| Lower Devonic | Coeymans limestone<br>New Scotland calcareous shale<br>Becraft limestone |

Above these limestone beds follows a series of sandy and silicious rock strata which are not the locus of caverns. These are:

| | |
|---|---|
| Lower Devonic | Oriskany quartzite<br>Esopus grit<br>Schoharie grit, |

all capped by the Onondaga limestone in which again caverns appear.

The upper terraces and summits of the plateau are constituted of sandstones and shales of Middle Devonic age and are not cavernous.

Professor Cook has submitted the following preliminary account of his researches.

In the Siluric and Devonic rocks of Schoharie and Albany counties there are three cavern zones which may be designated as the Onondaga, the Becraft and the Manlius. The first and second are sufficiently characterized by their names but the unbroken succession of lime rock formations between the Coeymans limestone and the Brayman shale (or, where this is absent, the Lorraine beds) must be regarded as a unit and the name Manlius applied to this zone is more or less arbitrary.

In this investigation it soon became evident that the subsurface drainage is dependent upon the geological structure of the region

in a way that renders the interpretation of the caverns a simple matter and affords some basis for a systematic prosecution of the work.

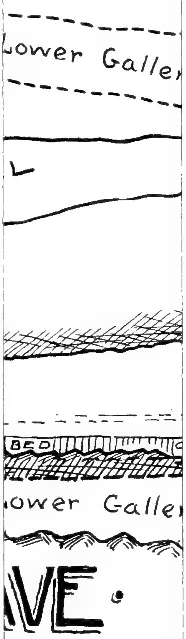
The influences controlling this drainage may be summed up under these heads: (1) the character of the successive terranes and the topographic forms resulting therefrom, (2) the strong southwest dip of the strata, and (3) the insequent stream valleys which have been cut in the peneplain to the level of the cavernous horizons.

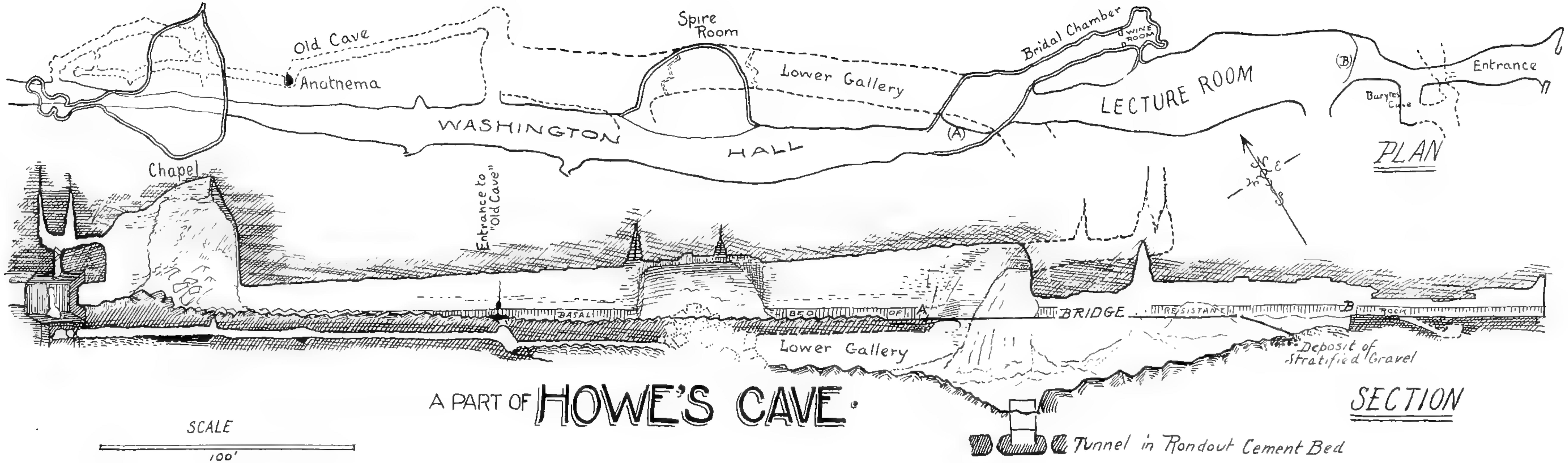
The normal retreat of the Helderberg escarpment along its northern and eastern face results in a series of terraces caused by the removal of the soft strata from between the harder, and the differential retreat of the terraces has left in places wide areas of permeable limestone exposed to the action of percolating water. Plateaus of variable extent are formed by the Onondaga, the Coeymans and, west of the Cobleskill creek (where the Oriskany quartzite appears to be absent or very thin), by the Becraft limestones.

When carbonated and acidulated meteoric water has once found its way into the joints and between the beds of the limestones thus rendered accessible, the excavation of caverns by solution will begin, provided the water can find an outlet at a level below that of its point of entrance into the rock. But the inclination of the strata southward precludes the possibility of exit above the line of strike passing through that point and, excepting along that part of the Helderberg escarpment which trends southeastward from near Altamont, it is only where a surface stream has cut its valley to the requisite depth and below the line of strike that an outlet is afforded. It is evident, therefore, that the age of these underground channels can be approximately fixed by estimate of the time at which their mouths were uncovered; and caverns of the same zone may be compared in this regard by reference to their distance from the head of the valley into which they open.

The diameter attained by a cave is primarily dependent upon the amount of water passing through it and the relative solubility of the rock. Disregarding meteoric conditions the volume of water is largely governed by the topography of the area drained by underground passages, the changes caused by surface erosion and the deposit of glacial material having in this way affected the Helderberg caverns considerably.

The life of a cave ends when the roof gives way and the channel is opened to day, a fate which may overtake it early in its development or be postponed for a long time, but is inevitable. As the


ower Galle
BED
ower Galle
VE




A PART OF HOWE'S CAVE

cavity is enlarged beneath thin or loosely coherent beds, these, deprived of support, fall into it and unless beds sufficiently firm to maintain their position lie above, the cavern will speedily be reduced to a ruin. Such "dead" caverns have a notable effect on topography, produce small sink holes or large rock basins with or without outlet and inlet. Though dead as caverns these areas may still be active fields of solution and erosion. Some instructive instances of such topographic forms, *Karsten,* resulting from the falling in of the caverns are to be seen on the Helderberg plateau.

Ideal conditions for the formation of large caves in thin-bedded limestone are furnished by the succession of hard and soft strata composing the Manlius zone. The Manlius is the cavern formation proper though passages in the Rondout and Cobleskill strata have been worked out where favorable conditions exist. The massive and resistant Coeymans limestone which yields slowly to erosive forces serves as a solid roof and a protection for the weaker rock beneath. The openings in the Coeymans limestone are all of the nature of deep vertical shafts worn along joint planes, and occasionally extending through the Manlius beneath. These shafts, locally known as "rock holes" occur at the bottom of broad trenches cut in the overlying New Scotland shale or upon high land where the shale has been nearly or quite removed. In the former case they receive the drainage of a considerable area and may be assumed to be in process of development; in the latter little or no water reaches them, their development together with that of the passages leading from them is at an end and they are of importance only as indicating former lines of surface drainage.

In this zone the main channel of every cavern investigated lies at the base of the Manlius, showing that the first water to penetrate the rock met with little opposition in making its way through the beds above that level. Some of the side passages for a greater or less distance from the foot of the shafts in which they originate, have been excavated above resistant beds higher in the series and in Howe's cave certain parts of the axial cavity have been formed by the deepening of channels first excavated in the upper strata (notably the "Bridal Chamber" and "Washington Hall") and other parts by the undermining of such channels (as the section filled by the "Rocky Mountains").

Little could be learned of the caverns in the Becraft limestone; three were found but only one was accessible. It appears from the evidence obtainable that solution begins in the lowest beds,

subsequent enlargement being principally due to the falling of slabs from the ceiling and their removal by the water.

The structure of the Onondaga limestone caverns can not be determined from the single cave visited at Clarksville and the short sections of passages accessible in the neighborhood of Thompsons Lake. The character of the arch in the heavier beds is quite distinctive but where thinner beds have been undermined the floor is littered with fragments of limestone much as in the larger Manlius caves.

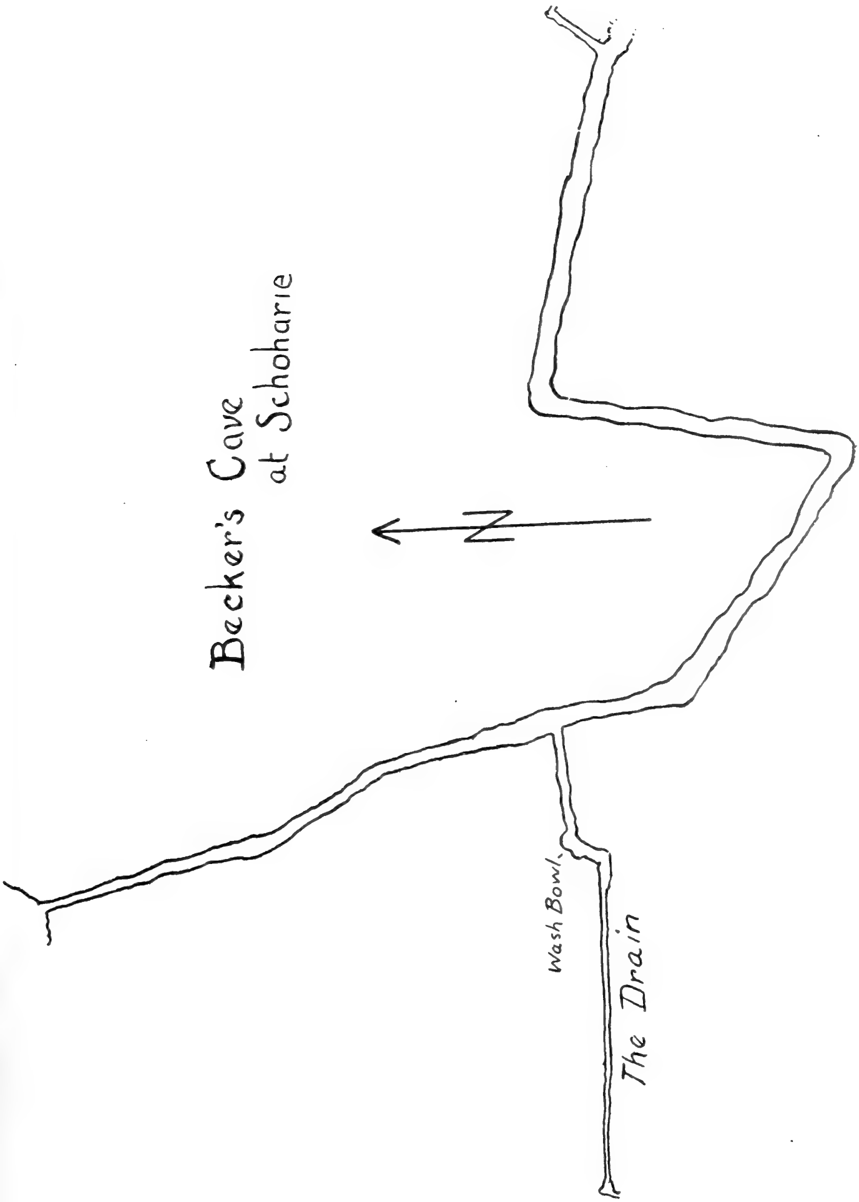
## Section I

### Caverns of the Schoharie valley

**Becker's cave** is located under Lasell park in the village of Schoharie. The entrance at the bottom of the low cliff behind the Lutheran cemetery opens near the base of the Manlius and clearly does not represent a mouth of the cavern. For 115 feet the passage is just high enough to enable one to creep, is between 2 and 5 feet wide and slopes noticeably downward. This part is nearly straight, the general direction being s. 15° e. (magnetic). It broadens gradually to 10 feet toward the further end where the floor drops sufficiently to permit of standing erect. Here a drain has been developed in the west wall. This is fairly commodious for 38 feet but drops abruptly to harder beds upon which the water has acted more slowly and the remainder of the passage which extends due west for 68 feet as a widened joint can be traversed only by lying flat. At the further end a crevice in the floor too small to penetrate serves to carry off the water to still lower beds, probably the Rondout dolomite.

The main passage was followed for 230 feet beyond the drain [*see* accompanying map] to where a small side passage enters from the north. Further exploration was prevented by ponded water and a low roof. This part of the cave is half full of clay and one must progress on hands and knees for almost the entire distance. No stream was flowing through it at the time of this visit and the pools contained no life. Neither stalagmites nor stalactites were found.

**Clark's cave** is on the opposite side of Schoharie creek about a quarter of a mile north of the Gebhard bridge. It opens in the lower Rondout beds and its explorable extent is less than 50 feet. To clear away the clay and rubbish which has accumulated about the mouth and thus drain off the water which fills it, would involve the expenditure of an amount of time and labor deemed unjustified in this preliminary survey.


Becker's Cave
at Schoharie
N
Wash Bowl.
The Drain

**Shelter cave** is the name given to a small cavern in the cliff back of the house of Mr Samuel Clark on the same side of the creek. It is excavated from the basal beds of the Becraft limestone, is dry except in the spring and after exceptionally heavy rains and can be penetrated for some 25 feet by a small person lying flat.

The Schoharie valley does not occupy a position favoring the supposition that a large cavern may open into it. Cut off from the plateaus to the north by the Cobleskill and Fox creeks, the terraces bordering it succeed one another too rapidly to afford any very extensive gathering ground for surface waters. The only opportunity offered would be where a stream coursing down the hillside had found access to the soluble limestones through heavily jointed beds. This is said to be the case where the brook flowing down the north face of Sunset hill at East Cobleskill crosses the Onondaga.[1]

## Section II

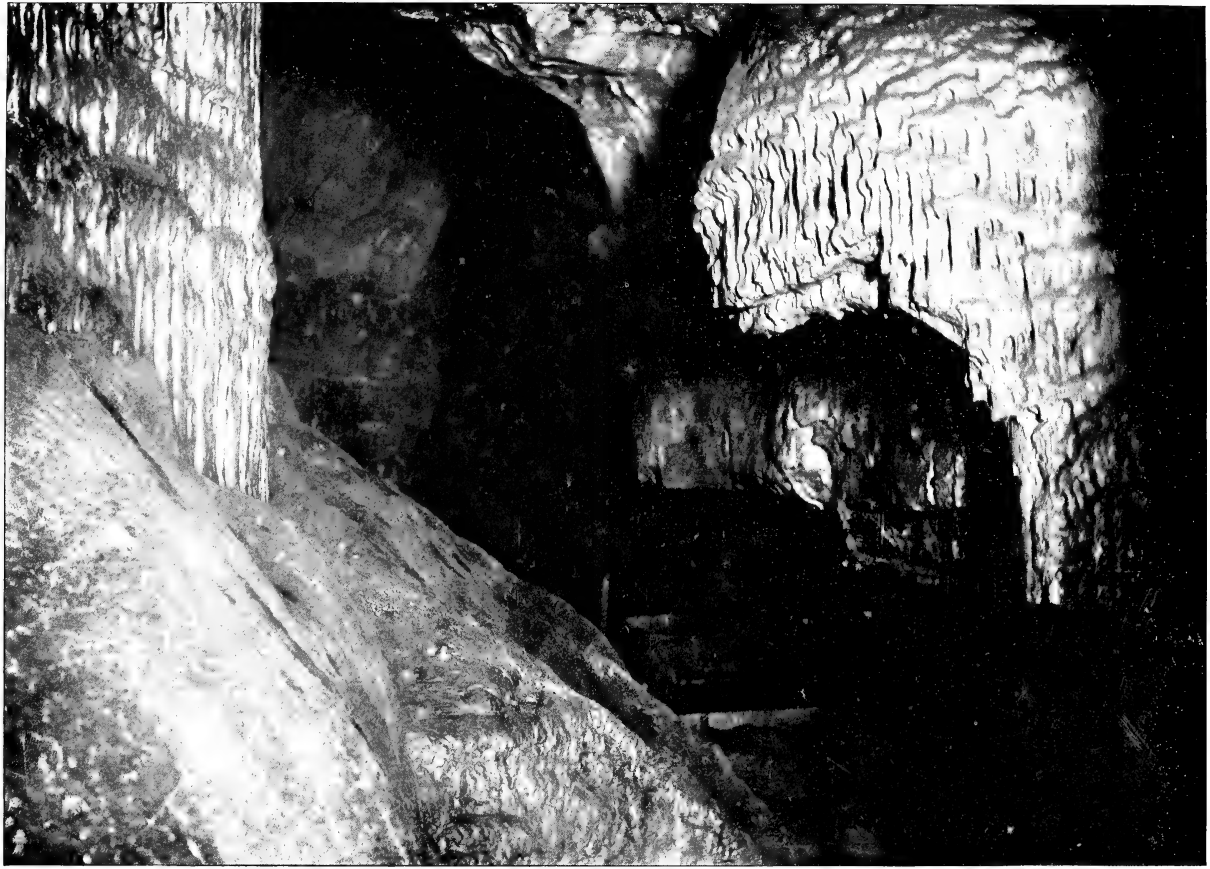
### Caverns of the Cobleskill valley

The Cobleskill valley receives underground drainage from the region north and west of it. All caves indicated by "rock holes" or streams disappearing in the limestones of this area as far as the Mohawk river undoubtedly open into this valley. Between Central Bridge and Braymanville the mouths of those of the Manlius zone are to be looked for. Only two were found but the existence of several others is indicated by springs.

**Howe's cave** is the largest cavern thus far discovered in the State. It is located 40 miles from Albany on the line of the Delaware and Hudson Railroad. The entrance is at the base of the cliff back of the hotel. The accessible part of the axial cavity extends for 4411 feet in a generally northwest direction and throughout its length the true floor, though for the most part covered by clay and fallen blocks of limestone, lies near the bottom of the Manlius where a series of resistant beds has formed what may be called a base level of ready solution above which the original channel was made. Ten side passages enter the cave from the north and the existence of six others coming from the same direction is to be inferred. Only one is of any considerable length and all the smaller ones are filled with clay or calcite. A fair-sized stream coming from a pool which fills the continuation of the cavern flows through the main cave to within 1160 feet of the en-

[1]Grabau, A. W. N. Y. State Mus. Bul. 92, p.193.

Plate 4



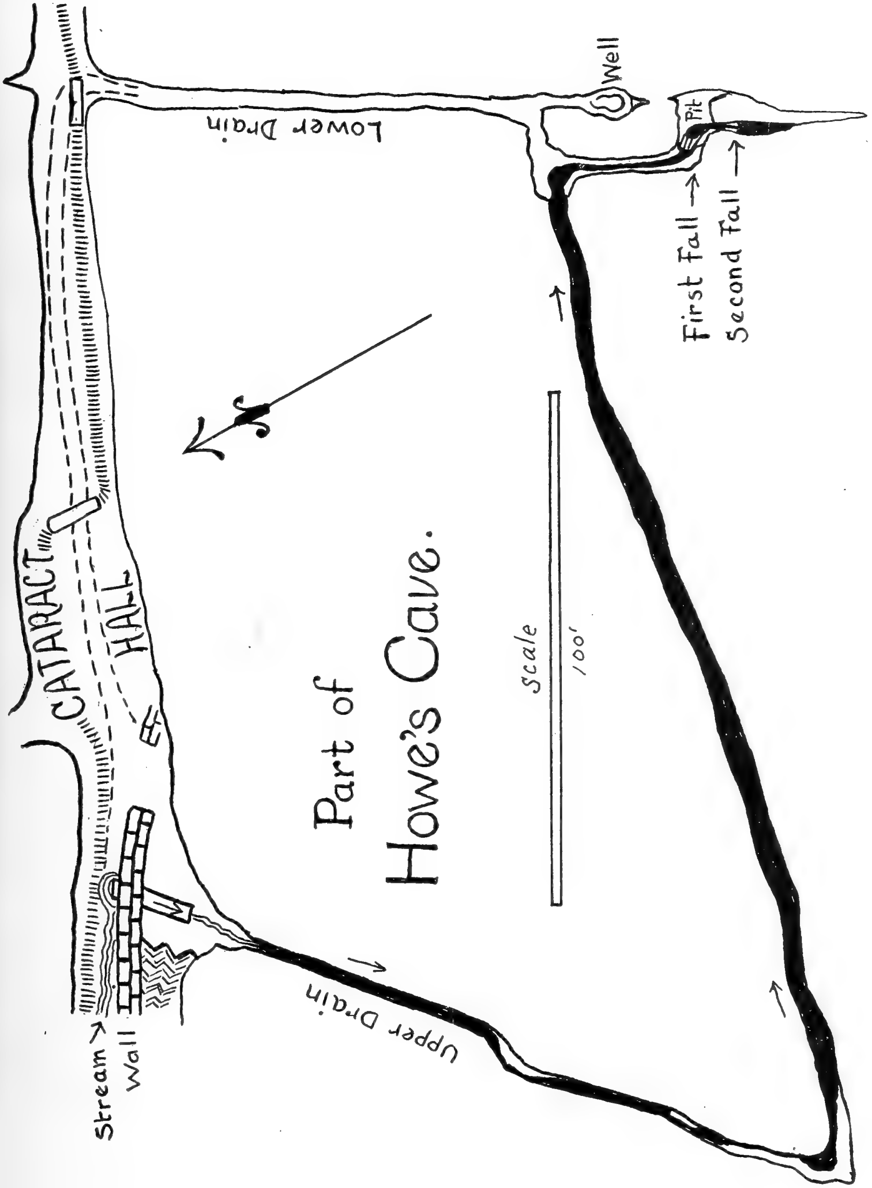
Howe's cave. Stalactitic formations at the upper end of the "Lake"

Plate 5

Howe's cave. The "Giant's Chapel," looking toward "Washington Hall." All but the lowest beds of the Manlius limestone are exposed in this room. The ceiling is of Coeymans limestone.

Plate 6

Howe's cave. The "Rocky Mountains" from the "Valley of Jehosaphat"


Part of
Howe's Cave.
scale
100'
CATARACT
HALL
Lower Drain
Upper Drain
Well
Pit
First Fall →
Second Fall →
Stream →
Wall

trance where it is drained off to the south along a joint. A second drain exists 150 feet beyond and carries some of the streams in times of high water. The drains unite as shown on the map on the preceding page, the stream finally disappearing through a crevice too small to enter and reaching the surface along the Cobleskill-Brayman contact line a short distance beyond the old cement quarry on the road to Braymanville. The drains can be penetrated by a person of average size who is willing to endure some discomfort. Both are narrow and the upper is full of water at all times. They are undoubtedly the latest passages developed in the cave.

The entrance is only one of several mouths which have at one time or another served to discharge water from the cavern, but the others are filled with clay and gravel beyond hope of clearing. One of these will be found in the face of the cliff in the upper Rondout beds, the passage leading to it forming a lower gallery known as the "Old Cave." For some 200 feet the floor of the main cave has fallen into this passage and the gap has been spanned with a wooden bridge.

Perhaps the most interesting part of the cavern is the inner end of the axial cavity and the branches reaching it. As has been stated the stream rises from a passage which lies below its surface. This is due to the fact that fragments fallen from the roof or walls and a quantity of gravel brought in through the branch caves have made a dam which reaches above the ceiling of the part now drowned. The "West Branch" comes in from the south and from a higher level; it is nearly filled with clay and broken blocks of limestone and ends abruptly at an impassable barricade of the latter. The other branch is called the "Winding Way," a name justified by its unusually tortuous course. From the main cave it runs north and ends in a small hole known as "Fat Man's Misery." This is seldom free of water. The passage beyond continues to the north for several hundred feet to "The Rotunda," a high domelike chamber appearing like a mighty gun barrel. It does not end here and is evidently passable for some distance further but is well filled with water.

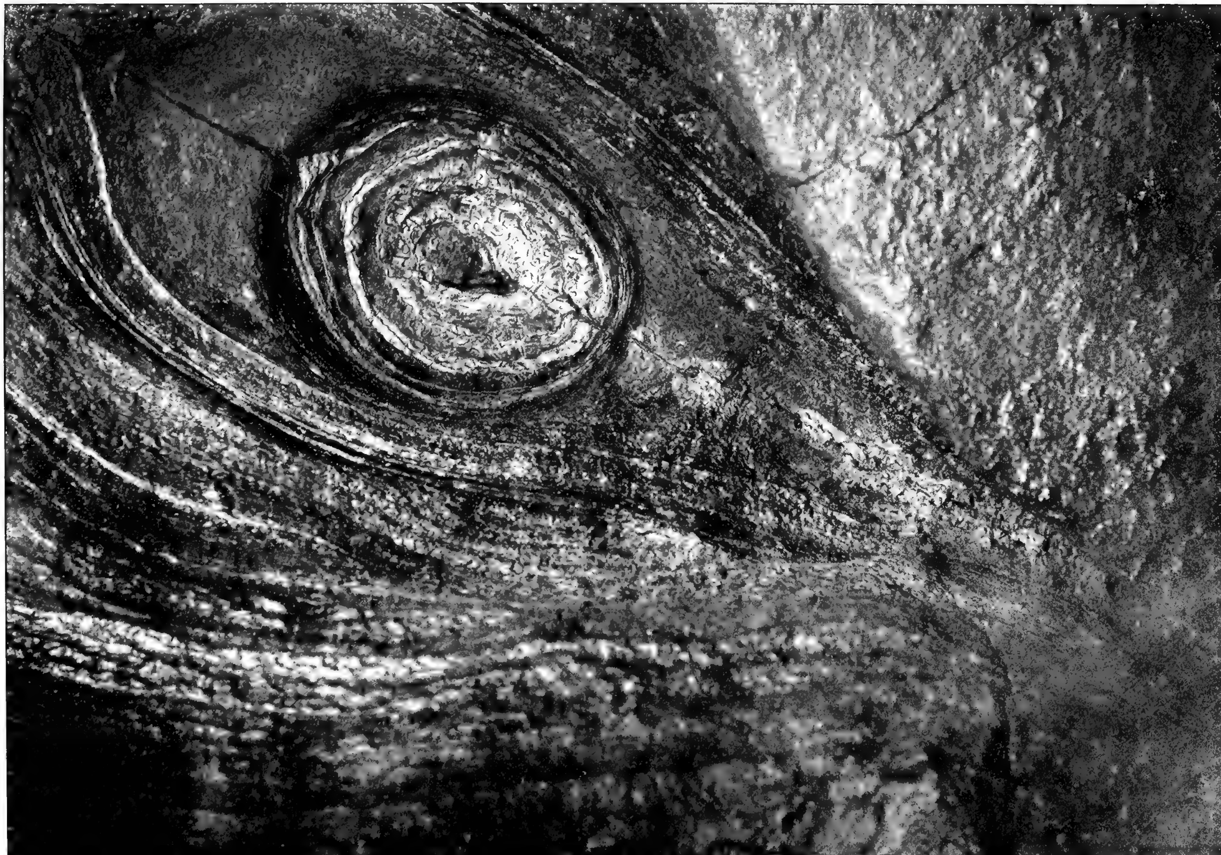
There are a number of tufa deposits in the cavern but few in the form of stalactites and they can hardly be said to add any beauty to the place.

The stream is inhabited by the blind amphipod Crangonyx tenuis (Smith) which however is the only true cave form to be found. As in most of the caverns a few stray frogs and earth-

Plate 7

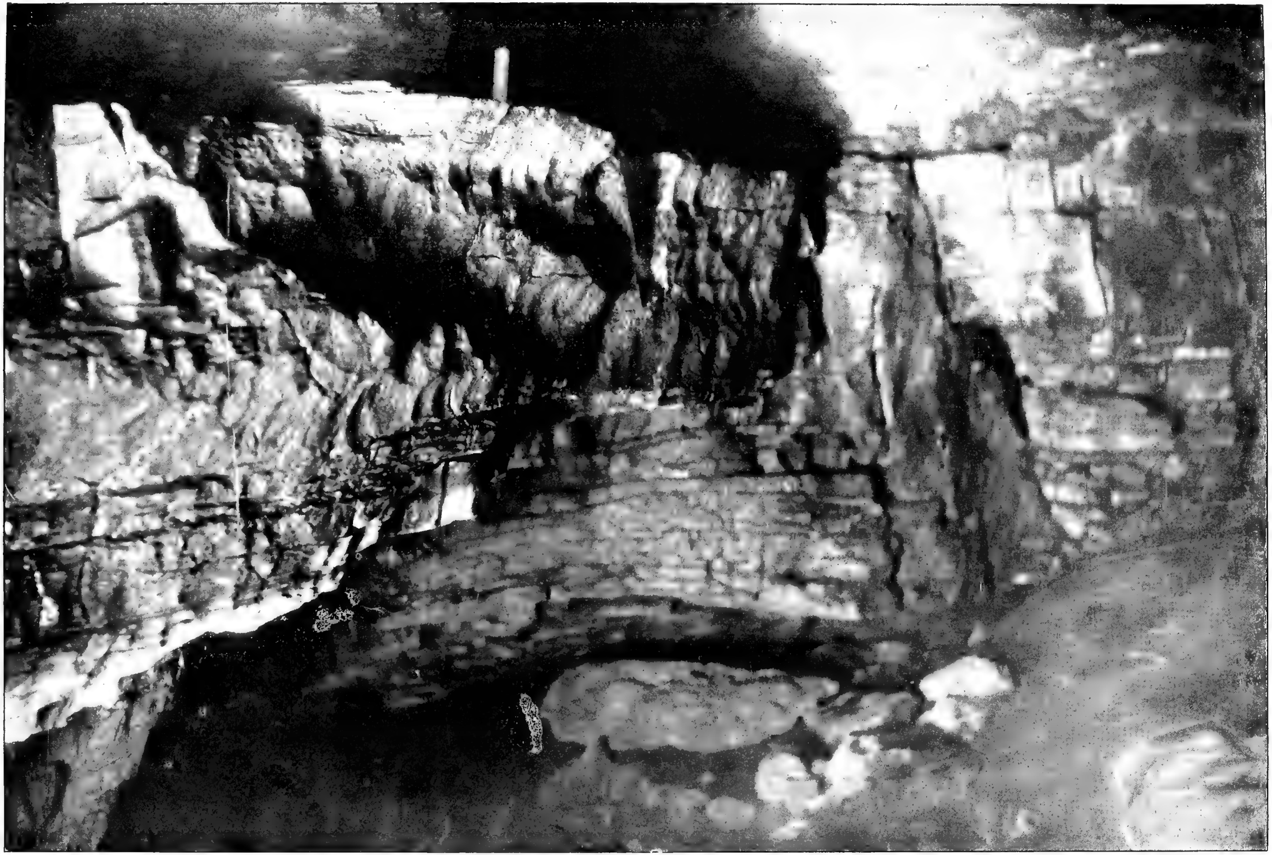
Howe's cave. "The Sentinels" — two pure white stalagmites overlooking the "Valley of Jehosaphat." View from top of "Rocky Mountains"

Plate 8

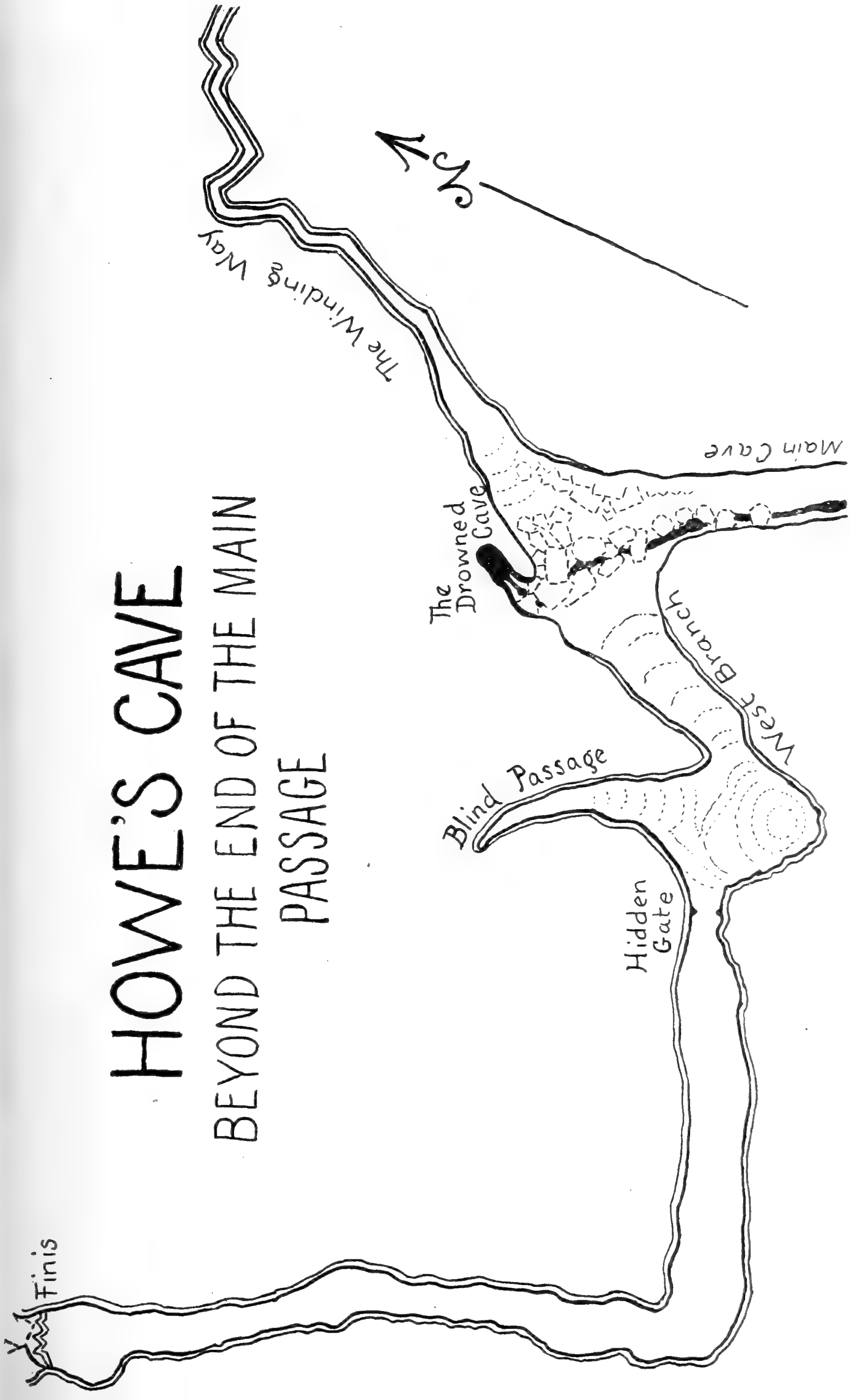


Howe's cave. "The Peacock's Feather"—a curious erosion form in the roof of the channel beyond "Cataract Hall"

Plate 9



Howe's cave. Passage at end of "Barytes cave" leading to an independent cavern in Rondout beds


HOWE'S CAVE
BEYOND THE END OF THE MAIN
PASSAGE
The Winding Way
N
Main Cave
The Drowned Cave
West Branch
Blind Passage
Hidden Gate
Finis

worms are occasionally met with in the summer and around the bridge, railings and ladders, where the mycelia of various species of fungi grow, beetles, myriapods and isopods may be discovered but all seem to be surface species which have undergone no alteration in the new environment.

The cave beyond the point where it is drowned is undoubtedly several miles long. "Rock holes" were found north of the western turnpike between Little York and Carlisle village and three surface streams south of the turnpike between these places disappear in the rock. Every effort was made to penetrate to the cavern below but these attempts were not crowned with conspicuous success. Running water near the base of the Manlius was found in **Sellick's cave,** a deep fissure traversing both Coeymans and Manlius on the farm of Chester Ottman 1 mile southwest of Carlisle village, but the passage through which it flows is blocked off from the fissure by the rubbish which has fallen through and almost closed the entrance. Just north of Carlisle Center several small streams fall into rock holes and reach the Manlius limestone. One of these shafts was opened with some difficulty and a small cave was found below it. This, however, was perfectly dry and no outlet could be discovered. It was named **Cave Disappointment.** Another of these shafts is known as **McFail's cave.** It received its name from an unfortunate man who lost his life while exploring it more than half a century ago. We were unable to penetrate to the cavern below but Dr R. J. Roscoe who was a member of the original exploring party has informed me that this runs northeast and southwest through the "waterlime" (Manlius) carrying a stream running southwest.

Beneath the entrance to Howe's cave was found an independent cavern in the upper Rondout beds which was explored for a distance of 1126 feet. It is excavated mostly along joint planes, is very narrow and contains several bodies of ponded water. Connection between this and Howe's cave has been established through the passage known as the "Barytes mine"[1] and clay washed in from the larger cavern has filled its lower end. It possibly originates in **Wolfert's cave,** a deep double shaft ⅓ mile due north of Howe's cave on the farm of Alonzo Wolfert, and a few rods east of the highway.

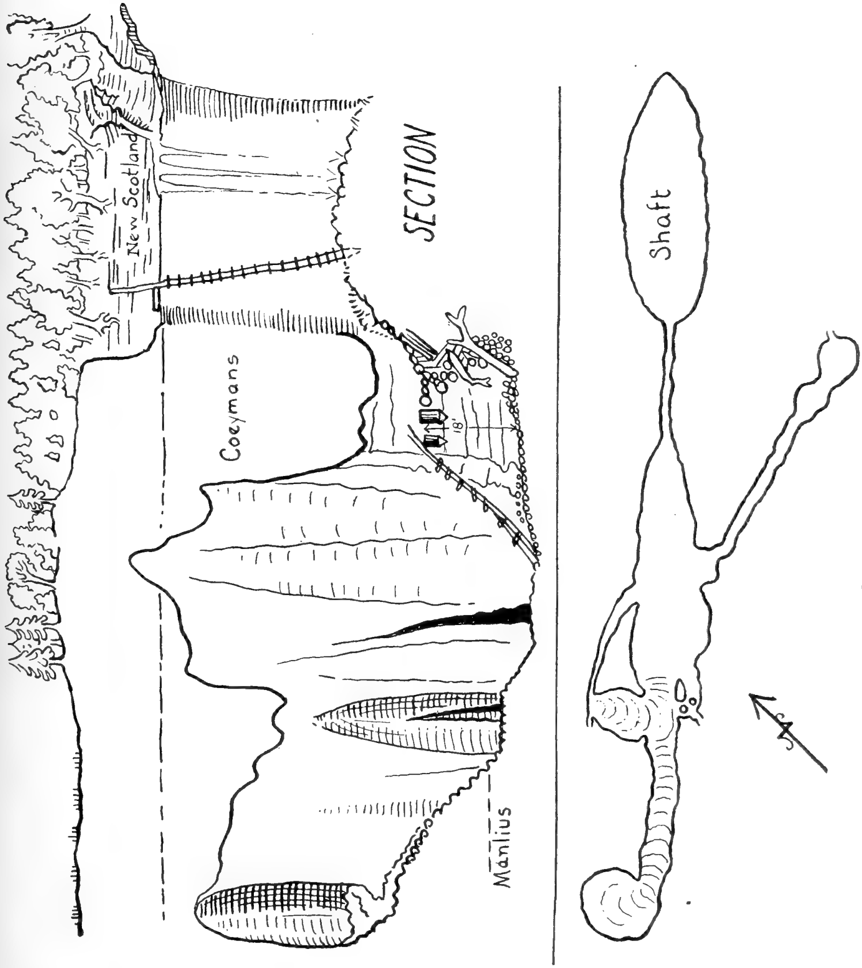
[1] Hovey, H. C. Celebrated American Caverns.

Plate 10

Sellick's cave. The entrance is a vertical drop of 34′.

Plate 11

"Cave Disappointment." The narrow crevice through which entrance was effected




CAVE DISAPPOINTMENT

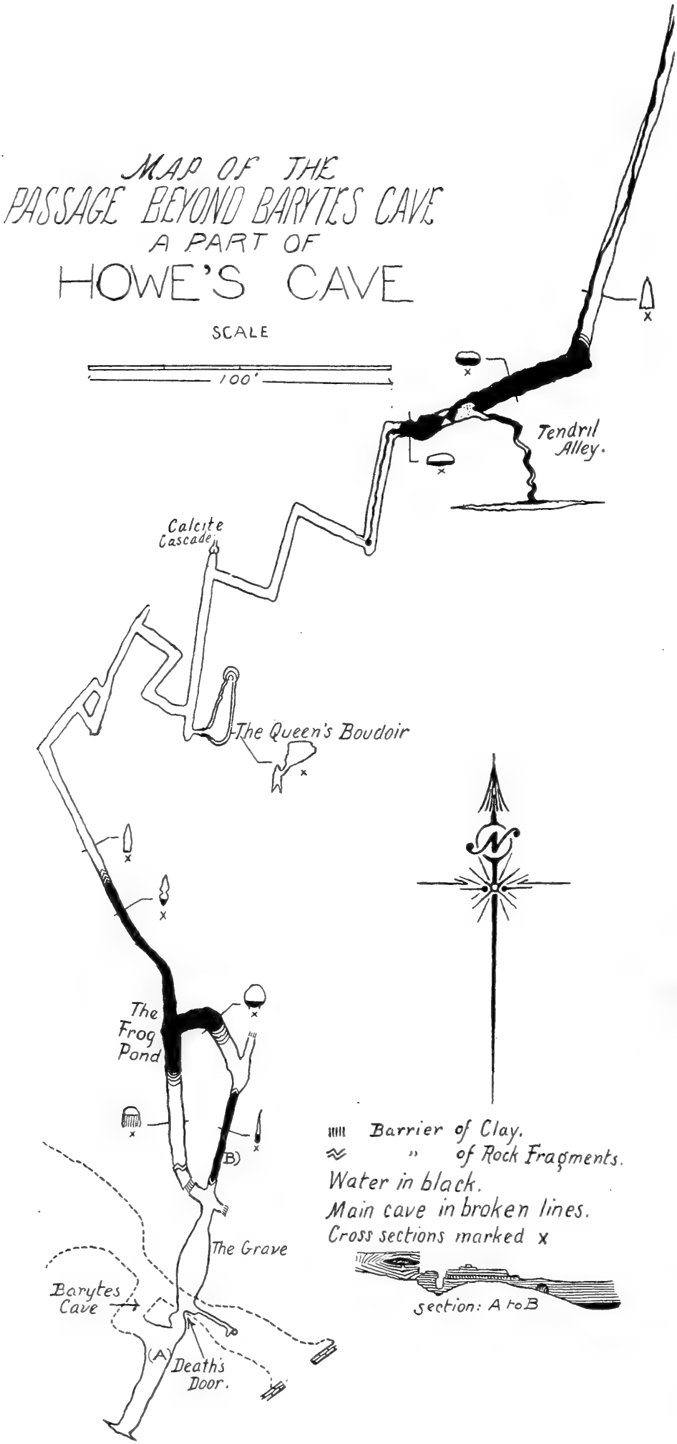

MAP OF THE
PASSAGE BEYOND BARYTES CAVE
A PART OF
HOWE'S CAVE
SCALE
100'
Tendril Alley.
Calcite Cascade
The Queen's Boudoir
N
The Frog Pond
(B)
Barrier of Clay.
" of Rock Fragments.
Water in black.
Main cave in broken lines.
Cross sections marked x
section: A to B
The Grave
Barytes Cave
(A)
Death's Door.

Plate 12

Becker's spring; formed by a cavern stream forcing its way through glacial drift

Half a mile n. 10° w. of Wolfert's cave on the property of J. M. Collins is **Benson's cave.** It may be followed for 1040 feet, the accessible part being excavated almost wholly along deep vertical joints. There have been stalactitic decorations in one of the conical domes but they have been broken to pieces by collectors. The passage is simple and twice doubles on its course in a rather peculiar manner, one section extending for 609 feet almost directly against the dip.

**Richtmyer's cave,** ½ mile further north is entered from a pit in the Coeymans limestone. It consists of a medium-sized room and a widened joint running southeast (both in the Manlius) and may be followed for about 300 feet. This may be connected with Howe's cave.

**Jack Patrick's cave** is located near the head of a gorge which opens into the Cobleskill valley between Howes Cave and Central Bridge. It is excavated along joints in the Cobleskill and Rondout with some solution along the contact line. It can be penetrated for only a short distance and is doubtless a drain which draws off the water from a large cavern in the higher limestones. The stream issuing from it is fairly strong even in dry weather. The cave probably parallels Howe's cave and may reach beyond Grovernor Corners where a small underground stream is to be found in **Pigmy cave** on the property of William Passage between that place and Carlisle Center.

**Youngs's cave,** on the farm of Spencer Youngs ½ mile due west of Carlisle Center is excavated in the Becraft limestone and discharges a stream into the southern end of the trough at the opposite extremity of which are McFail's cave and Cave Disappointment. The roof has given way for most of its length but is intact for three or four hundred feet. Ponded water and a low ceiling prevent one from passing underground from one end to the other.

There is another subterranean waterway in the Becraft which deserves attention although all efforts to penetrate it failed. It extends from the depression on the farm of Leroy Lawyer 1¼ miles north of Russell lake, to Becker's pond, a spring 80 feet in diameter and 25 feet deep, a little more than ½ mile south of Shutts Corner. It receives also the drainage from a depression on the farms of William Brown and Chester Kniskern a mile and a half west of Carlisle Center and probably also a stream which falls into a fissure in the Becraft near the barn of David Chambers between Carlisle Center and Shutts Corner.

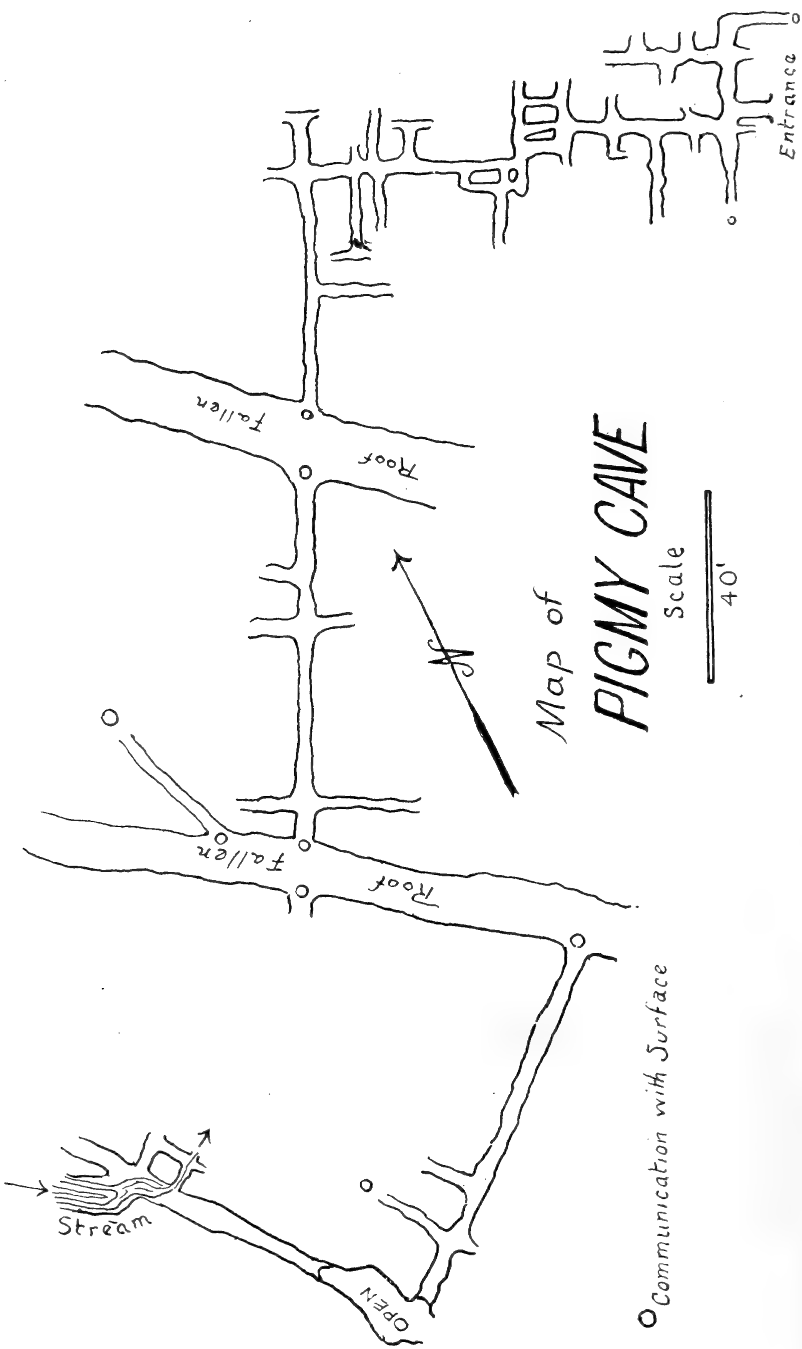
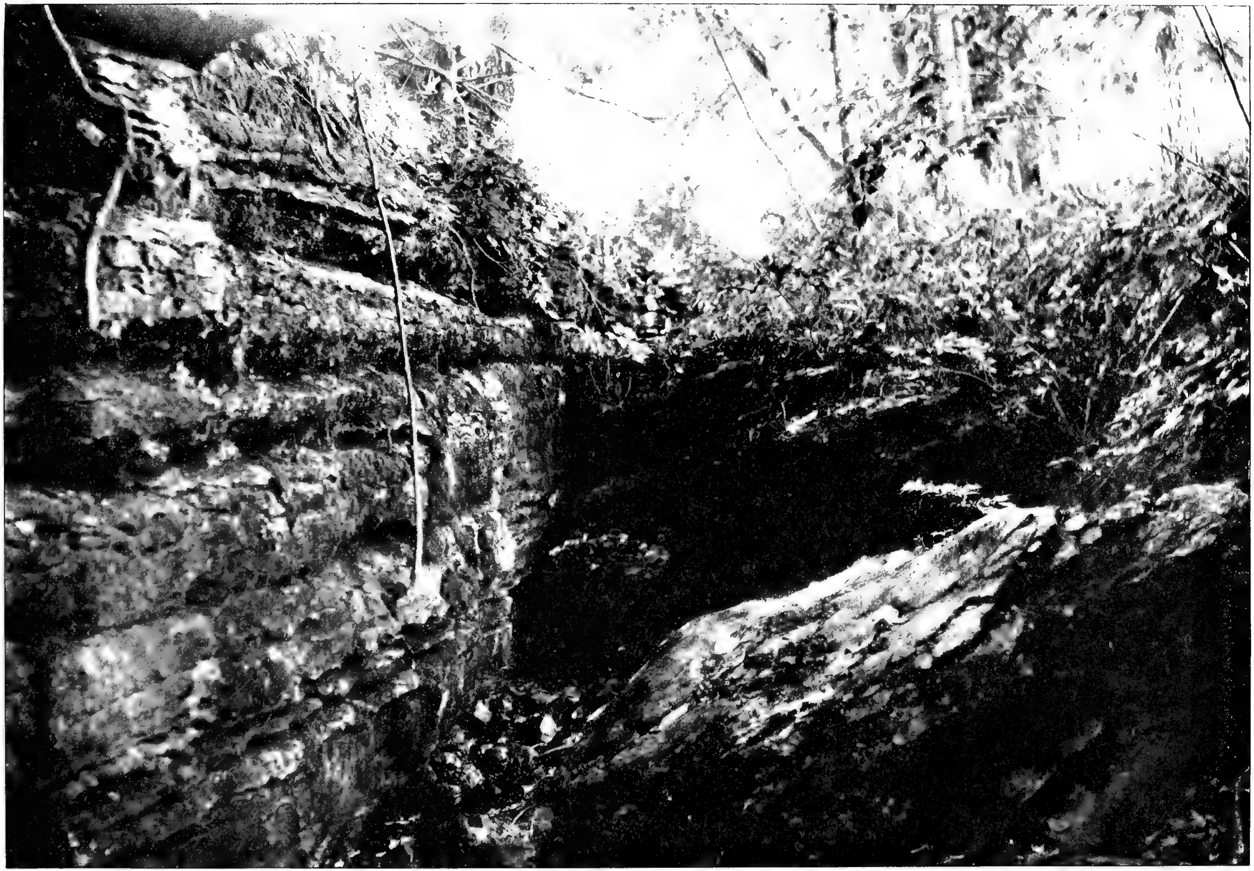

Map of
PIGMY CAVE
Scale
40'
N
Entrance
fallen
Roof
fallen
Roof
Stream
OPEN
Communication with Surface

Plate 13



Young's cave, in unprotected Beeraft limestone. The fate of a cavern

## Section III

### Caverns of the Fox Creek valley

The valley of the Fox creek receives underground drainage from the region lying north of it. Cut nearly along the strike in its lower course, it offers conditions favorable for the excavation of a number of small caves but a large one is hardly to be looked for. Without exception the mouths of these were found to be choked by deposits of the cavern streams or buried by glacial material.

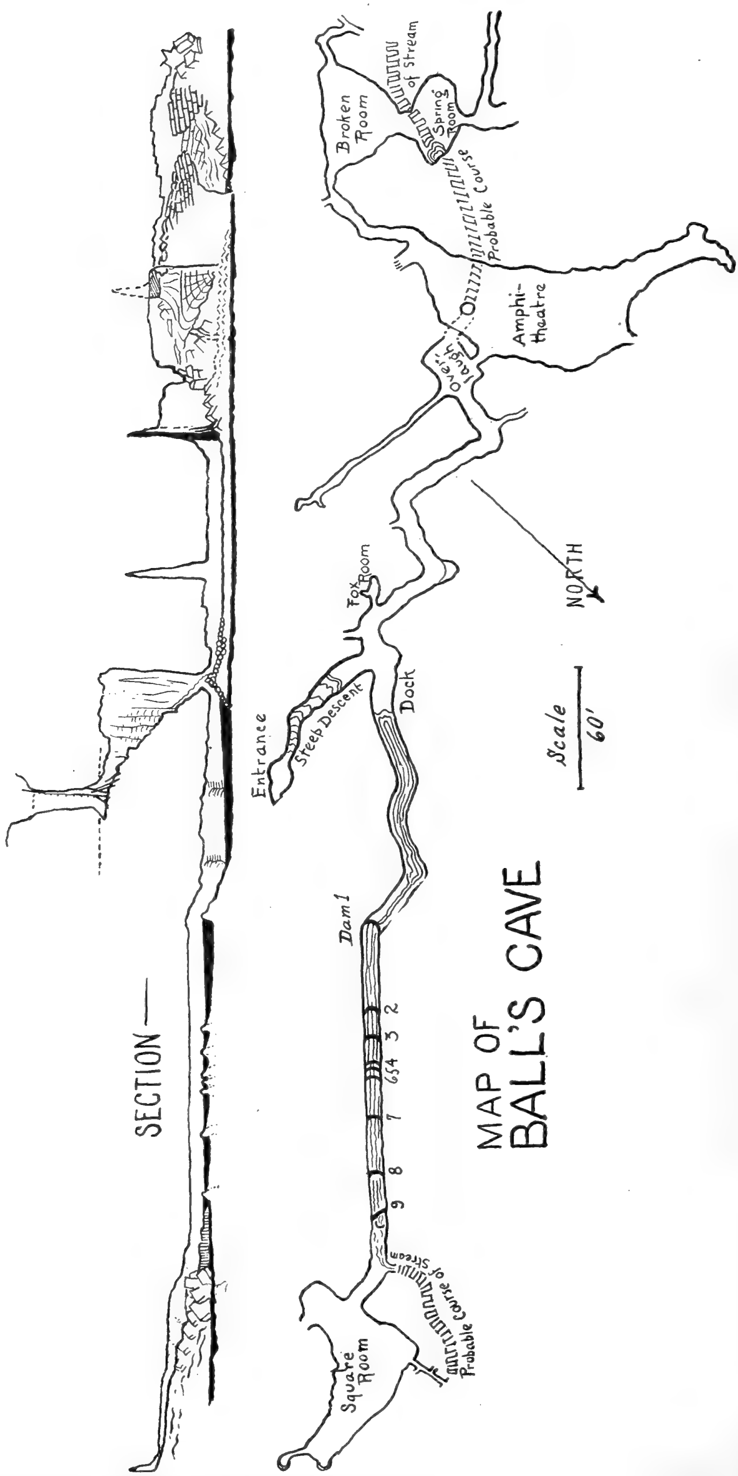
There is one on the Martin Spateholts farm at Shutter Corners, another near the head of the Louse kill, and a third farther down the same stream above the sawmill on ground owned by Wesley Wilbur.

**Ball's cave** is the only one of the group which is accessible. The entrance is a vertical shaft in the Coeymans limestone located on the north side of Barton hill, 3/5 mile southeast of the point where the road to Quaker Street crosses the county line. It is reached by a wood road from the house of Edwin Dietz and admits one to a cavern which, as far as can be seen, has been dissolved out of the basal Manlius beds.

A steep descent from the bottom of the shaft leads to a point in the cave about midway between the limits of exploration in either direction. At some seasons the whole cavern is full of water but usually the downstream (southwestern) half can be traversed without a boat. This part extends for 200 feet to a mass of fallen fragments which must be climbed in order to reach what has been spoken of in the meager literature of the cave, as its chief attraction, a large room named the "Rotunda" or "Amphitheater." Nothing remarkable was found in the chamber and published descriptions which have pictured it as "rich in stalactitic decorations" have been drawn from perfervid imaginings rather than from facts.

This room and the passages beyond it lie at a level higher than that of the principal channel which is buried by clay and fragments. The cave stream appears as a spring in the last chamber reached and disappears again almost immediately beneath a mass of limestone precipitated from the roof.

The upstream (northeastern) end of the cavern always contains water which in places is as much as 7 feet deep. The stream is retained as a series of pools behind natural dams of tufa formed apparently as deposits from flowing water. Three hundred and

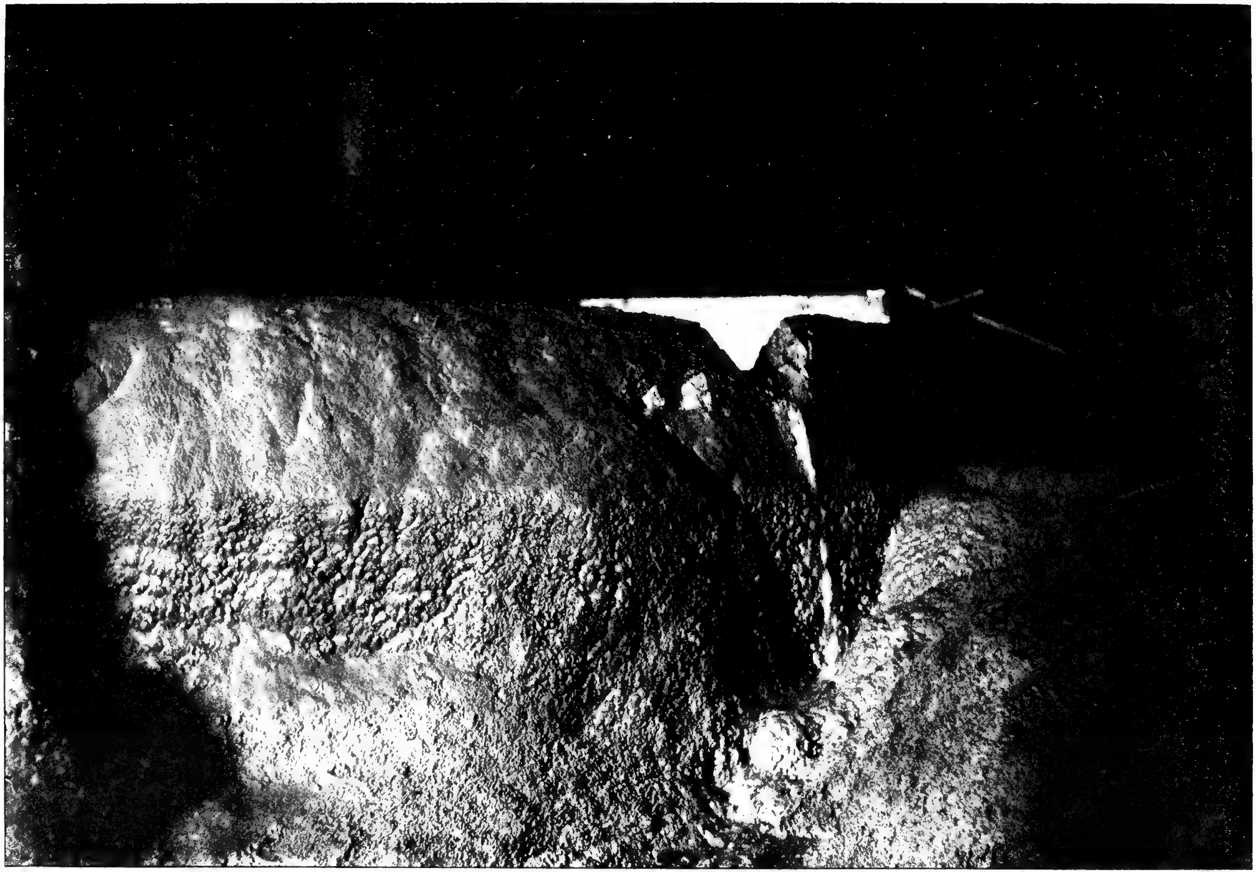


SECTION —
MAP OF
BALL'S CAVE
Broken Room
of Stream
Spring Room
Probable Course
Amphi-theatre
NORTH
Fox Room
Dock
Entrance
Steep Descent
Scale
60'
Dam 1
2
3
654
7
8
9
Probable Course of Stream
Square Room

Plate 14

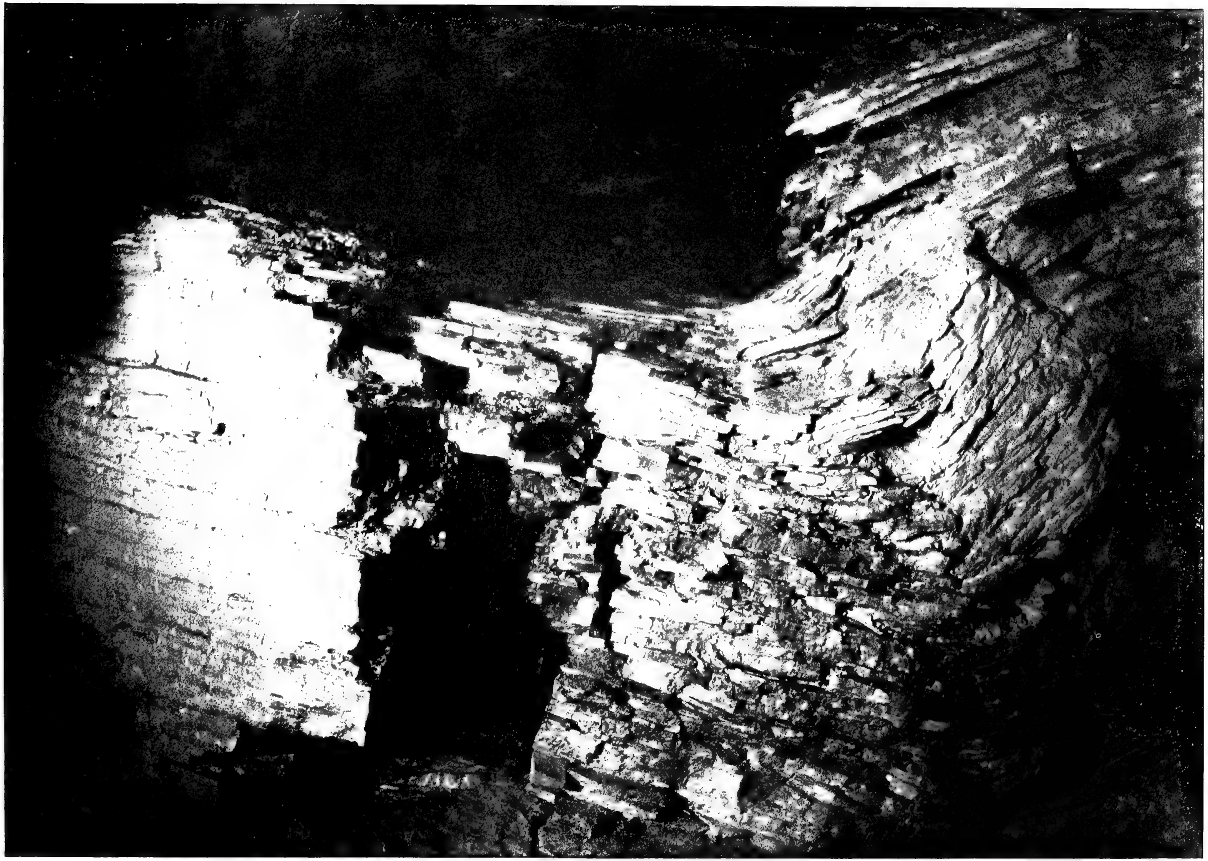
Ball's cave. Vertical entrance shaft

Plate 15



Ball's cave. First tufa dam

Plate 16



Ball's cave. Entrance to the "Broken Room"

thirty feet from the beginning of the water this end of the cave expands into a chamber at a higher level beyond which the passage is small and so filled with water and soft clayey mud that it is practically impassable.

## Section IV

### Caves of the Helderberg mountain

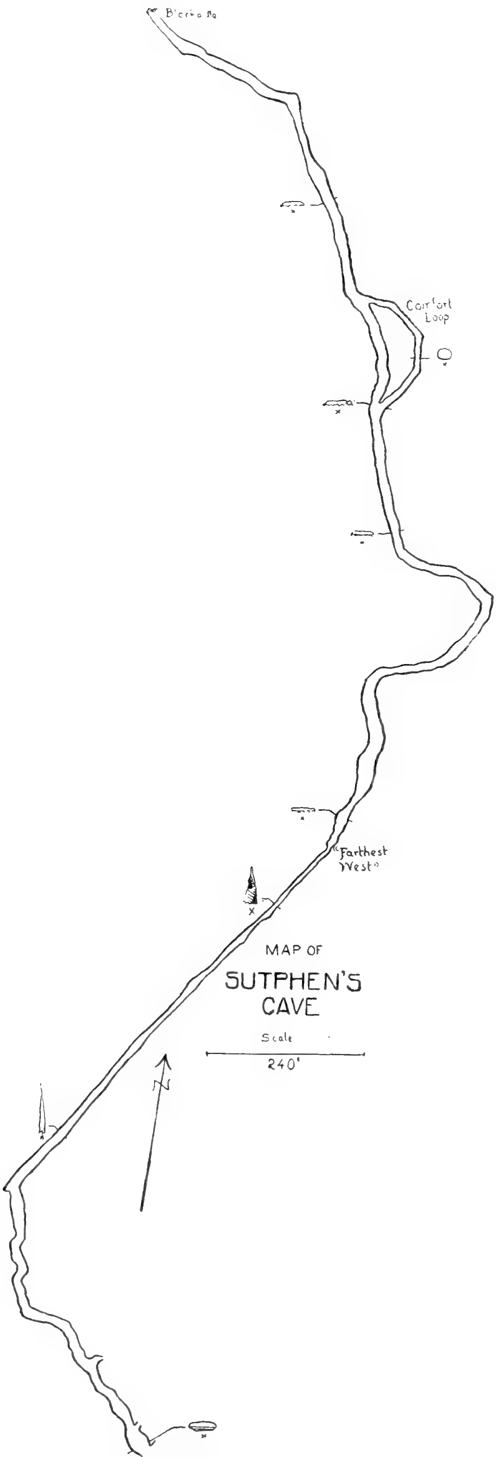
Several caverns exist at the base of the Manlius limestone between Altamont and New Salem but because of the limited area draining into them they have not developed to a size that renders them accessible, and only one was found large enough to enter. This is known as **Sutphen's** or **Thacher's cave** and is on the property of Hon. John Boyd Thacher of Albany. It is located at the base of the cliff beyond the alcove north of the Indian Ladder road and is most conveniently reached by crossing the fields back of the house occupied by Mr Albertus Hallenbeck or near the top of the "Ladder."

The passage for the first 530 feet is broad and low with pools of water at intervals. The general direction of this first section is n. 40° w. Then for 750 feet the cavern is a high narrow joint running n. 35° e. toward the face of the cliff. At the end of this section the incongruous legend "farthest west" has been painted upon the wall. The remainder of the cavern averages 2 feet in hight and 12 in width, extending irregularly to the northwest for 1603 feet, beyond which it is impossible to go. A small branch which leaves and returns to the main passage, something over 600 feet from the farther end is clear of clay and fragments and high enough to permit one to walk in a stooping position. For this reason it was named "Comfort Loop," the comfort being purely relative.

Thacher's cave probably receives its supply of water (which is intermittent) from the area surrounding a depression 1 mile northwest of its mouth.

**Wynn's cave** and **Livingston's cave** near High Point, south of Altamont are remnants of caverns whose streams were active before the cliff had retreated to its present line. The former extends for several rods, the latter is scarcely more than a room.

These caves are all in the Coeymans-Manlius series.




MAP OF SUTPHEN'S CAVE

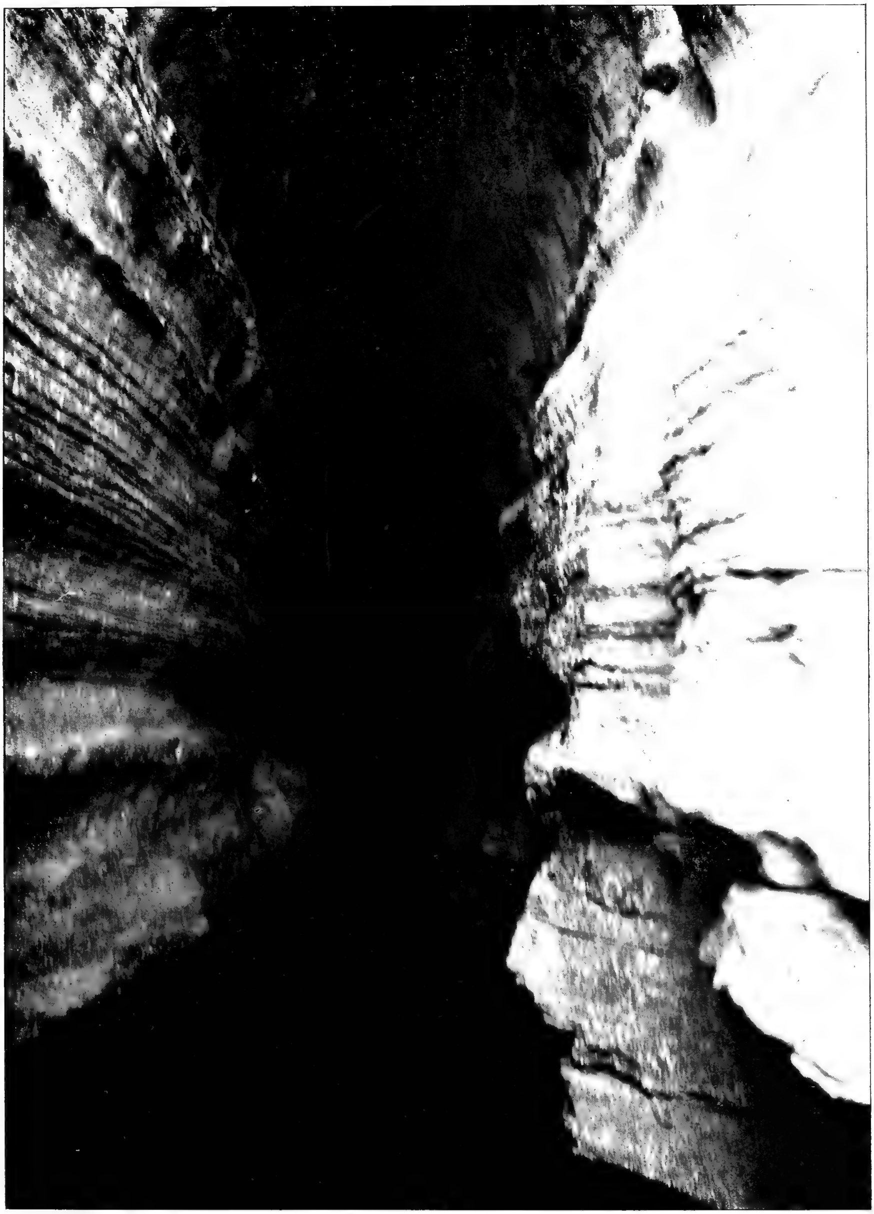
Plate 17

The "Proscenium arch"—the limestone wall overhanging the entrance to Thacher's cave. Hight 105'. Cave entrance at the base and not shown in the view

Plate 18

Thacher's cave. One of the pools near the entrance

Plate 19



Thacher's cave. The widened joint constituting the second section

## Section V

### Caves of the Onisketheau valley

Two caves are known to exist on the north side of this creek, one in the Manlius where that formation is brought to the surface in an anticlinal fold 1½ miles southwest of South Bethlehem, the other at Clarksville. The former was not visited.

The **Clarksville cave** in its lower course is nearly filled with gravel and for a long distance is inaccessible. A short section may be entered near the road running east and west through the village, and a short distance from the old hotel. It is called the "Little cave." A longer section, the "Big cave," is entered at the top of the hill north of the shorter part. The cave presents usually a smooth rounded arch in the harder beds, though in the thinner beds the floor is littered with fragments and presents much the appearance of a Manlius cavern. A stream flows through it at all seasons and empties into the Onisketheau creek south of the village. It is ponded in the larger section some rods from the entrance and it would be necessary to build a boat in the cave to cross the water. It is quite possible that this stream enters the rock opposite the church near Thompsons Lake, but this can not be determined without further exploration. The cavern is in the Onondaga limestone.

#### INTERNATIONAL COMMITTEE ON GEOLOGICAL NOMENCLATURE

This is a committee organized by the joint action of the Geological Survey of Canada and the United States Geological Survey for the purpose of attaining a uniformity of nomenclature for the rock formations traversed by the international boundary and spreading thence north and south. During the past season the New York-Canada boundary was under special consideration by a subcommittee represented by Drs F. D. Adams and A. P. Coleman of Canada, Professors J. F. Kemp and C. H. Van Hise for the United States Geological Survey and Prof. H. P. Cushing for the New York Survey. This field conference involved the review of areas of crystalline rocks within the Adirondack region and north of the New York line. The results are believed to be entirely satisfactory to all interests concerned.

#### INTERNATIONAL CONGRESS OF GEOLOGISTS

The convention of this international body representing the geologists of the world was held in September 1906, in the City of Mexico. As it was impracticable, because of more pressing engagements, for the State Geologist to be present this institution

was represented by Dr R. Ruedemann, one of the secretaries of the organization.

### PALEONTOLOGY

## Correlation studies

**Early Devonic of Gaspe.** In my report of last year mention was made of the comparative study of the Devonic faunas of New York with their manifestation in the regions northeastward to the Atlantic border. The treatment of this subject constitutes the matter for Museum memoir 9, the first volume of which is now all in type and the lithographic plates well forwarded. This volume will concern itself with accounts of the Devonic faunas of Gaspé and their relations to those of New York. The profusion and excellent preservation of the representatives of the New York faunas in that region has afforded important light on the proper grasp of the developments in New York. A conception of the fulness of the presentation of these faunas is conveyed by the fact that it has required about 50 quarto plates to represent these faunas adequately.

In 1900 I proposed definite stratigraphic terms for this Gaspé Devonic, grouping the divisions which had previously been made by Sir William Logan and to validate these terms it has been necessary to analyze their faunas in detail. This work pertaining to the eastern Devonic has proceeded with deliberation because of its wide scope. It will require some time yet to bring it to a conclusion and for this reason it has seemed well to establish some of the results attained in the course of the work by a preliminary account of some of the species, which has appeared in Museum bulletin 107.

**Paleozoic faunas of eastern Maine.** In order to facilitate the work referred to above, I commissioned Mr O. O. Nylander to make collections of Devonic and Siluric fossils from the region of Cobscook Bay, Me. His investigation, occupying a few weeks of the field season, resulted in acquisitions of very considerable interest both to the collections of the Museum and to the problems under investigation. The localities represented are on Moose island, Carlton island, and various points in the town of Perry. Fossils were found for the first time in the purple shales at Pembroke and considerable collections made from Siluric strata on the west side of the Pennomaquan river and other points in the town of Pembroke.

**Early Devonic strata at Lake Memphremagog.** An examination of the upturned and much cleaved and altered strata at the south end of Lake Memphremagog has brought out some facts which may serve to throw light on the character of the faunas. Near Knowl-

ton's Landing, Dr Ruedemann has recorded a section where about 100 feet of erect grit strata with Taonurus are both underlain and overlain by dark argillites. The former, on account of the presence of the Taonurus or "Cauda-galli fucoid" have been correlated as "Esopus grit" by the Canadian geologists. The argillites, however, both above and below these Taonurus grits, contain fossils; a Dalmanites nearer to the D. coxius of the Grande Grève limestone than any other that occurs to me and an Orthoceras with a well defined and peculiar surface which I have not seen in other species. There are traces also of other fossils. It seems hardly an accurate expression to correlate these beds with the Esopus grit of New York on the basis alone of the presence of Taonurus which is now recognized as of direct or indirect mechanical origin and occurs freely in sandy sediments of different ages. The fossils of the adjoining conformable shales will determine the age of this deposit. At Owl's Head fossils were obtained from the altered limestones; these are chiefly corals, though brachiopods are also present. The preservation is execrable but the corals, Favosites, Heliophyllum, Phillipsastrea and the brachiopods Atrypa reticularis, Spirifer like S. acuminatus and a large Rhynchonella, seem to entirely confirm the correlation by the Canadian geologists with the Onondaga limestone. The two sections referred to are several miles apart.

**The Rensselaer grit.** Eastern Rensselaer and northern Columbia counties are covered with a mantle of arenaceous deposits lying unconformably on the upfolded Cambric and Lower Siluric strata beneath. The character and distribution of this rock was clearly outlined by Lieutenant Mather in his report on the first geological district (1843) and its equivalence with the Shawangunk grit of Ulster and Orange counties suggested.

As the early geologists held the latter to be an eastern equivalent of the Oneida grit of central New York, the Rensselaer grit has consequently been assigned the same value in correlation. We owe to T. Nelson Dale of the United States Geological Survey an intimate knowledge of the stratigraphic relations of this terrane to the unconformable rocks beneath and also the conclusion that the upfolding of the lower and the upper terranes pertains to different dates, the former to the Taconic uplift and the latter to the Post-devonic or Carbonic uplift which also produced the more southerly synclinals now represented by Becraft mountain, Columbia co. Mr Dale has correlated the Rensselaer grit with the entire Oneida-

Medina sedimentation. The recent work of C. A. Hartnagel as published in these reports indicates conclusively that in the typical section the Oneida conglomerate is not a formational unit but actually lies within the Medina sandstones, that further the Shawangunk grit on stratigraphic evidence alone, is of an age much later than the Medina formation and being overlain conformably by rocks of Postsalina age is probably the eastern representative of the Salina deposition. The essential confirmation of the latter conclusion by the discovery of an eurypterid fauna in the Shawangunk grit is elsewhere referred to. Mr Hartnagel has pointed out the improbability of the Siluric age of the Rensselaer grit or of its equivalence with the Medina-Oneida sediments, his chief arguments being (1) the extensive gap by nondeposition between the eastern terminus of the Oneida conglomerate in Herkimer county and the Rensselaer grit plateau, (2) the long time interval that must be postulated to account for the Taconic folding and the erosion that preceded the deposition of the grit, (3) the gradual transgression northward of arenaceous sediments over the eroded folds, the Shawangunk grit being a more southerly and hence earlier representative of such transgression. The region has been carefully searched during the past season for some evidence of fossils which would throw definite light on the problem of the age of this Rensselaer grit, but though this evidence still fails and can not be explained by secondary changes of the rocks, the stratigraphic considerations indicate the propriety of assigning to this formation a distinctly later age.

No beds later than Trenton age have been observed near the edge of the plateau and there are apparently no outliers to bridge the gap between the late Siluric and early Devonic rocks of Becraft mountain, Mt Bob and the last outlier of the Rensselaer grit in the town of Austerlitz, Columbia co. This last outlier is of especial interest because it lies but 20 miles northeast of Becraft mountain and is situated a considerable distance south of the main mass of the Rensselaer grit plateau. For these reasons it was specially studied but found to be in no way lithologically different from the Rensselaer grit in Rensselaer county and containing the same alternations of grit with red and greenish slates.

From the presence of only the closing stage of the Upper Siluric at Becraft mountain and in the Helderbergs near Albany, (Countryman hill)—the two places where the deposits of the Siluro-Devonic basin of New York approach nearest to the Rensselaer

grit plateau — it may be properly inferred that the Upper Siluric sea of New York did not extend into the present area of the Rensselaer grit plateau at any time except possibly in the Manlius age. In regard to the latter, the problem is the same as in regard to the Helderberg limestones in general which are exposed at Becraft mountain and of which the Rensselaer grit might represent the littoral facies. In favor of this view it may be said that both rest on the same basis (Cambric and Lower Siluric slate) and that on account of the rising of the Taconic mountains in early Siluric time, there may have existed a littoral facies of the Helderberg rocks to the east. But this view is strongly opposed by the fact that the Helderberg rocks do not show any indications of approach to a littoral region at Becraft mountain, but retain the same lithologic characters that they possess over a vast area. There would hence have to be assumed an extremely abrupt and improbable change in facies in the short distance of 20 miles from Becraft mountain to the outlier at Austerlitz. An exception to this seems to be made by the Oriskany sandstone, Esopus grit and Schoharie grit which not only contain sand and grit at Becraft mountain and in the Helderbergs, but in some places as at Whiteport and Kingston, contain conglomerate beds. It is altogether probable that the material of these conglomerates was derived from the south and the Oriskany sandstone is too thin a layer (30 feet) at Becraft mountain, to be correlated with the thick mass of the Rensselaer grit (1400 feet). It is, however, possible that the Esopus and Schoharie grits which at Becraft mountain have a combined thickness of 300 feet and are similarly barren in fossils, once continued northeastward into the Rensselaer grit trough. Since they represent an invasion of the sea that came from the south and spread northward in the direction of the Rensselaer grit plateau, and the overlapping Rensselaer grit is clearly the product of an invading, not a receding sea, it is a question for consideration whether the Rensselaer grit was not deposited in a long narrow embayment extending northward from the Oriskany-Esopus-Schoharie grit sea of southern New York. But in this case also, there is still to be explained the extremely rapid change from the typical Esopus grit of Becraft mountain to the red and green slates and coarse grits of the Austerlitz outlier, and the fact that the Esopus grit is thicker southward (700 feet in Orange county), and thins out toward Becraft mountain. The regular succession of the various members of the Lower and Middle Devonic in Becraft mountain with the same lithologic

characters as in the Helderbergs and much farther west and south is undeniable evidence that the Helderberg sea extended farther east than the present Rensselaer plateau and with unchanged or but little changed conditions. In this connection it is further to be considered that the Rensselaer grit plateau has clearly its main extension in a north and south direction, (according to Dale, there is a further outlier in Vermont) and represents a deposit in a long submeridional Appalachian trough. Its pebbles of coarse and fine gneiss came from a short distance and the numerous Lower Cambric pebbles probably from places north of the plateau. It is therefore the deposit of an embayment which may have received its materials from the north. The entire absence of fossils in the nearby Becraft mountain formations is a further argument against correlation with the latter, as it indicates estuarine conditions greatly different from the marine conditions of the Helderbergian sea depositing the Becraft mountain rocks.

These indications of estuarine conditions in the Rensselaer basin, consisting in the alternation of red and other highly colored shales with coarse grits and conglomerate and the barrenness of the beds in fossils, suggest a possible identity with the Catskill beds which loom up across the Hudson, thousands of feet thick and only 30 miles away from the outlier of Austerlitz. There is no doubt that the deposits of the Catskill estuary must have extended to and beyond the Rensselaer grit plateau; the main extension of that estuary as already shown by the writer was in the same direction as the Rensselaer plateau. The thickness of the Rensselaer grit corresponds better with that of the Catskill beds than with any other, the lithologic characters are similar, and both have in common the barrenness in fossils.

From the location of the Rensselaer grit plateau relative to the Siluric and Devonic rocks of New York and its lithologic characters, the Rensselaer grit would be most naturally connected with one or another of the two Devonic phenomena referred to, viz, the Oriskany invasion or the Catskill embayment.

**Eurypterus fauna of the Shawangunk grit.** Reference has been made above to the discovery, after the determination of the age of the Shawangunk grit of Orange county as probably equivalent to the Salina of central New York, of beds bearing Eurypterus intercalated in these grits. In another place I have given a full account of the stratigraphy and character of this fauna and here briefly summarize the principal facts of this very noteworthy and

highly significant discovery. The Shawangunk grit throughout its extent along its western ridge from Ulster county into the Kittatinny mountains of New Jersey and on its eastern from Skunnemunk mountain, Orange co. to Green Pond, N. J., had never furnished fossils until the work of the past season brought them to light. In some of the Orange county exposures it has been found that above the basal conglomerate of the formation through the grit layers for a thickness of about 600 feet there are frequent repetitions of thin, black shale layers, inconstant in extent and in number along the outcrops and most of them bearing the remains of merostome crustaceans, of the genera Eurypterus, Pterygotus, Hughmilleria and their allies. The fauna must have been an extensive one as the remains are various and abundant but the preservation leaves much to be desired especially in the case of larger crustaceans whose surface has afforded opportunity for shearing and consequent deformation or destruction of the parts. Yet in some respects the preservation has been remarkably favorable for small individuals and these shales have afforded the most diminutive examples of these interesting creatures yet brought to light. The presence here of the genus Hughmilleria, heretofore known only in the Pittsford shale at the base of the Salina series in Monroe county, is sufficient evidence of the contemporary age of this arenaceous mass.

In themselves the fossils are extremely interesting affording some details of ontogeny not before recorded for these ancient Merostomes. It is entirely evident in the writer's opinion that these crustacean faunules running through the strata for so great a thickness indicate temporary and very changeable brackish water pools over the surface of a rapidly accumulating delta derived from the drainage of the high folded lands to the northeast, the deposit laid down in an embayment entirely separated from the salt pans and Dead Sea conditions of central and western New York by a barrier lying approximately in the present position of the Helderberg mountains.

**Utica shale at Otisville.** The Shawangunk grit at Otisville lies unconformably on the so called "Hudson River" shales and the exposures recently created at this spot have afforded some light on the proper correlation of the parts of this vast homogeneous formation. These rocks near Otisville have afforded a considerable number of graptolites and the brachiopod Schizocrania filosa. The leading species of graptolites are Climacograptus typicalis, C. bicornis and Diplograptus

quadrimucronatus, all characteristic of the Utica shale of the Mohawk valley.

The aggregation shows the extension of the Utica shale fauna, hitherto traced by its fossils only to the neighborhood of Albany, into this southern belt of the formation and close to the boundary of New Jersey, in which state the continuation of the same shale belt has thus far furnished only the Normanskill (middle Trenton) graptolite fauna.

### SPECIAL PROBLEMS

**Graptolites of New York.** In 1905, part 1 of a monograph of the graptolites of New York by Dr Ruedemann, Assistant Paleontologist, was issued. This work embraced the species of the earlier strata. The second part comprising species of the later Lower Siluric, Upper Siluric and Devonic has been in preparation for several years and is now completed.

These faunas contain considerably more than 100 species, mutations and varieties, all from the State of New York. The scope of the work has been extended as far as practicable to all the graptolite shales of the United States, for while through Hall's pioneer work in this field the graptolite shales of New York have furnished the standard for all the graptolite beds of America, it is desirable that the occasion of this revision of the New York faunas should be used to compare these with those of the continent and to determine as far as possible the paleogeographic distribution of the various graptolite zones. One of the most interesting of these extralimital faunas is the Normanskill (middle Trenton) fauna from Alabama. This has been found directly between Trenton limestones, thereby demonstrating the correctness of the conclusion arrived at before by indirect evidence that the Normanskill graptolite shale is of Trenton age.

This second part contains an introduction; chapters on the morphology of spines; on the disks in Climacograptus bicornis; on the vesicles upon the nemas in species of Diplograptus and Climacograptus which are found to be inflations of the outermost perisarcal layer, obviously serving to increase the buoyancy of the rhabdosomes, and on the so called axis or virgula of the Dicranograptidae which is found to be not homologous to that of the other Axonophora, but of different secondary origin. The composition of the successive faunal zones and their paleogeographic distribution are given, the careful comparison of the species with those of other countries allowing more correct correlations

than were formerly possible. It is found e.g. that both graptolites of the Clinton shale, Monograptus clintonensis and Retiolites venosus are identical with two graptolites (M. priodon and R. geinitzianus) that have a very wide distribution in Europe and characterize one of the many graptolite horizons of the European Upper Siluric. Thereby it becomes possible to correlate with precision the upper Clinton beds of New York with a definite European graptolite horizon.

**Genera of the Paleozoic corals.** On several occasions reference has been made to the study of the Paleozoic corals which was carried on during the later years of the life of Prof. James Hall and provisionally brought to a close not long after his death. The undertaking was one of broad scope and attended with many difficulties. So serious did the latter appear that it was deemed wise not to attempt the publication of the work in the form in which its author left it, but to insure its accuracy by placing it for revision in the hands of an expert student of the corals. My desire to bring about this revision has not been successful until this year when an arrangement was perfected with Dr T. Wayland Vaughan through which his services will be given to the work as he can command them. Dr Vaughan has been able to devote some time to this undertaking during the past season and will continue his efforts to unravel a very tangled and involved problem which has already cost a large expenditure of time and effort.

**Devonic crinoids of New York.** Sufficient progress has been made in the study of the crinoids to justify the expectation of early completion of the Camerate genera.

**Monograph of the Devonic fishes.** This work, referred to in my last report, is now in press.

**Mastodons.** In a previous report I entered into a detailed account of the discoveries of remains of mastodons in this State since the original excavation of such remains, a short distance below Albany, in 1705 [Report State Paleontologist 1903]. The following memoranda are here added to the record.

CHEMUNG COUNTY

**? 1799, 1855.** The paragraph which follows is from Dr W. M. Beauchamp's bulletin on Indian Place Names in New York [N. Y. State Mus. Bul. 108. 1907].

Chemung has various forms, as that of Skeemonk in 1777, and Shimango in 1779. In 1757 the French spoke of the "Loups of

Chaamonaque or Theoga," meaning the Delawares living at Tioga. It was written Shamunk in 1767, but usually Chemung. The river and an Indian village bore this name, which meant *big horn*. The village was burned in 1779. Zeisberger has Wschummo for *horn*, and the locative may be added. Spafford said: "Chemung is said to mean *big horn*, or *great horn*, in the dialect of the Indian tribes that anciently possessed this country. And that a very large horn was found in the Tioga or Chemung river is well ascertained." This was a Delaware name, and the river has another of similar meaning. In Schoolcraft's larger work is a communication from Thomas Maxwell, who gave the usual definition and said that the name came from a large horn or tusk found in the river. Of course this must have been in colonial times to have originated the Delaware name. The early settlers found a similar horn in the stream in 1799. It was sent to England, and an eminent scientist called it the tusk of an elephant or some similar animal. In 1855 Mr Maxwell added:

One of much the same character was found on an island in the river below Elmira, a few weeks since, and it is now here. I have recently examined it. It is about 4 feet in length, of the crescent form, perhaps 3 to 4 inches in diameter. Capt. Eastman saw it yesterday and with others who have seen it pronounce it to be ivory, and a tusk of some large animal, probably now extinct. This is the third horn or tusk which has been found in the Chemung so that the name is likely to be perpetual.

### ORANGE COUNTY

**1899.** Parts of a skeleton were exhumed near the village of Arden on lands of Mr E. H. Harriman. Efforts made to secure all the bones resulted in uncovering only a few portions of the scapula or pelvis, leg, ribs and two teeth. The soil was peat or vegetable mold.

### CATTARAUGUS COUNTY

**1906.** Parts of a skeleton represented by 40 to 50 bones mostly vertebrae and foot bones were found in the banks of the State ditch along the Conewango creek close on the boundary between Cattaraugus and Chautauqua counties. The remains lay above a shelf of hard clay. Discovered and reported by C. N. Hoard and W. H. Hoard, Conewango valley, September 23, 1906.

### WESTCHESTER COUNTY

**1906.** A tooth and some small fragments of bone were found on the property of W. H. Fish, Hartsdale.

**Fossil plants.** As opportunity has afforded, Mr David White has continued his investigations of the Devonic plants. He has given

special attention to the examination of the very large Upper Devonic "Lepidodendron" in the Museum — a specimen measuring 11 feet, 6 inches in length and with the root complete. As originally taken out this fine fossil had a length of 15 feet. Mr White has submitted the following note concerning this tree.

*Archaeosigillaria vanuxemi* Goepp. (sp.). This slab carries the basal portion of one of the earliest representatives of the great group of the Lepidophytes, a group of enormous extent and of treelike proportions in the older Coal Period (Carbonic), though survived now only by the relatively unimportant and humble Lycopodiales, including the club mosses ("ground pines" and "ground cedars") in the flora of today. The forerunners of the Lepidophytes in the Devonic, found but rarely and in a very fragmentary condition, were very much smaller than their Carbonic descendants from which they differed by certain systematic characters.

The stem here shown is extraordinary not only for its rarity, relatively fine preservation, and large size as compared with other Devonic plants, but also for the fact that it combines in one individual trunk some of the features which serve to characterize and differentiate several distinct later lepidophytic groups. It represents the type ancestral to these groups.

The base of the stem is truncated, probably as the result of decay of the main roots; but the small ribbonlike rootlets, articulated at typical stigmarian areolate scars, are still in evidence at the extreme butt. The latter is much dilated as the result of a very great thickening of the bark, and possibly by the development of some secondary (exogenous) wood in addition, so that the rows of leaf cushions are widely separated and frequently displaced in a way similar to that found in the base of some Carbonic sigillarian trunks and even in certain old trunks of Lepidodendron. Traces of leaf cushions are observable down to within 5 centimeters of the bottom of the specimen.

The stem rapidly contracts above the enlarged base and the number of leaf cushion rows, is, at the same time, greatly increased by the intercalation of new series. In this portion of the trunk the leaf cushions are sigillarian in form and they are placed in vertical rows, each row occupying the median area of a longitudinal rib, the cushions in the same row being separated by transverse grooves across the rib in an arrangement characteristic of the Favularian section of the Rhytidolepis group of the Carbonic Sigillariae.

Halfway up the trunk the leaf cushions are longitudinally more distant, while those near the borders of the specimen exhibit a rhomboidal form, which is clearly in a spiral arrangement, similar to that familiar in the Lepidodendra. Still higher they are narrowly rhomboidal, or obscurely fusiform, closely placed, slightly asymmetrical, and partially overlapped obliquely in the same vertical row. In this portion of the trunk the spiral arrangement is very sharp and the vertical costation is obscure except where exaggerated by lateral pressure along the median zone. In fact the form and arrangement of the cushions are essentially characteristic of the Carbonic Lepidodendrons. They are typical of the Devonic lepidophytic material described by authors as Lepidodendron, though really differing from this genus by the characters of the leaf scar.

An interesting phase in the preservation of the trunk (seen at two thirds of its length) consists of the aspect of imbricated bracts or slivers. The latter correspond to the casts of the nerve sheaths passing outward and upward through the cortical tissues which in this region are partially macerated. The structure observed in this portion of the trunk is that sometimes seen also in partly decayed trunks of Lepidodendron, Bothrodendron and Asolanus, and represents the false genus, or condition of preservation, described as Knorria.

The leaf scars are well shown in the second and third quarters of the specimen. The scar, placed on the upper part of the cushion, is longitudinally oval and is provided with relatively long crescentic lateral cicatricules (parichnoi) that form a horseshoe beneath the nerve trace in the subepidermal impressions.

As in most of the other Devonic representatives of this group the leaves seem to have adhered to the bark, even after the branches and trunk had attained considerable size. Short, rather lax, slender, and inconspicuous examples, standing nearly at a right angle to the trunk, may be observed at various points along the periphery of the stem, especially on the left near the top. In form and habit they agree with the leaves of Lepidodendron and Bothrodendron.

As a whole, the trunk is seen to combine rootlet characters of Stigmaria; dilation and leaf cushion form and arrangement characteristic of Sigillaria in the lower part and of Lepidodendron in the upper portion; and a Knorria structure similar to that found in Lepidodendron, Bothrodendron, and the sigillarian Asolanus while the leaf scars are in character nearest to those of Cyclostigma (Bothrodendron), with which, as well as Lepidodendron, the leaves

themselves agree. The specimen represents a Devonic type that was ancestral to the Carbonic groups, Bothrodendreae, Lepidodendreae, and Sigillariae, mentioned above. Though combining and foreshadowing some of the distinctive characters of the later groups, it differs generically from all by the combination of these features, by the angle of the leaf spirals (phyllotaxy) and the details of the leaf scar itself.

*Locality.* Mouth of Grimes gully, 2 miles west of Naples, N. Y.

*Formation.* Hatch shale.

*Stage.* Upper Portage.

## III

## REPORT OF THE STATE BOTANIST

The State Botanist reports that the number of species of plants added to the flora of the State is 67. The number of species of which specimens have been added to the State herbarium is 155. Of these, 59 are species new to the herbarium, 95 not new. Of the former number 19 are considered new or undescribed species and descriptions of these will be found in his separate annual report. A list of the names of the added species is given under the title " Species added to the herbarium."

Though the season for the most part has been unfavorable to the development of fleshy fungi the investigation and collection of specimens of these interesting plants have been continued and 38 species of fungi have been added to our mycological flora. Of these 16 are new species. There have been added also 1 new species of panic grass and 2 new species of Crataegus or thorn bushes.

The trial of the edible quality of species of wild mushrooms has been continued as opportunity was found and has resulted in finding 11 species deemed worthy of addition to the list of edible fungi. This raises the list of New York edible species of mushrooms to 183. Of the 11 added species, 9 have been illustrated by colored figures of natural size on 6 octavo plates. Figures of the 2 remaining species, Russula earlei Pk. and Boletus rugosiceps Pk. have already been given; the former in Bulletin 67, plate N, figures 5–10, the latter in Bulletin 94, plate Q, figures 6–10.

The collection of specimens of species of Crataegus has been continued. Specimens have been procured in the northern, eastern,

central and southwestern parts of the State. The number of species added to the flora and represented by specimens in the herbarium is 8. Of these, 2 are new to science. Many specimens of this genus yet await identification.

About 20 species of trees are represented by botanical specimens not included in the foregoing enumeration. These were collected for the purpose of replacing those that were damaged or lost in the St Louis and Portland Expositions.

During the interval between the collecting seasons of 1905 and 1906 the annual report for 1905 was prepared, an additional table case of specimens of parasitic fungi was placed on exhibition and the contribution of the Osaka Mushroom Merchants Association, the receipt of which was acknowledged in the annual report for 1905, was prepared for exhibition and placed in the botanical exhibit room of the State Museum. A revision of the New York species of the two large and somewhat difficult genera, Russula and Hygrophorus, was made and in many cases more complete and satisfactory descriptions of the species have been written.

The assistant in botany has been chiefly occupied with office work. He has incorporated the collections of 1905 in their proper places, has disinfected and labeled the specimens, attended to the correspondence in the absence of the Botanist, identifying specimens sent for determination and giving information sought concerning them. He has prepared a card catalogue with descriptive references of the new species of fungi described by the Botanist.

## Species added to the herbarium

*New to the herbarium*

Allionia hirsuta *Pursh*
Amanitopsis pulverulenta *Pk.*
Ascochyta pisi *Lib.*
Aster arcifolius *Bu.*
A. elaeagnus *Bu.*
A. fragrans *Bu.*
A. multiformis *Bu.*
A. violaris *Bu.*
Boletus subpunctipes *Pk.*
Caryospora cariosa *Fairm.*
Collybia campanella *Pk.*
C. lacerata *Lasch.*
Cortinarius intrusus *Pk.*
C. validipes *Pk.*
Crataegus arcana *Beadle*
C. bissellii *Sarg.*
C. cognata *Sarg.*
C. deltoides *Ashe*
C. habereri *Sarg.*
C. noveboracensis *Sarg.*
C. scabrida *Sarg.*
C. tenella *Ashe*
Cynoglossum boreale *Fern.*
Didymium clavus (*A. & S.*) *Rabenh.*
Dryopteris pittsfordensis *Slosson*
Entoloma minus *Pk.*
Flammula expansa *Pk.*
Gaura coccinea *Pursh*
Hydnum luteopallidum *Schw.*
Hygrophorus burnhami *Pk.*
H. luridus *B. & C.*
Hypocrea pallida *E. & E.*
Inocybe pallidipes *E. & E.*
Lepiota asperula *Atk.*
L. eriophora *Pk.*
Leptoglossum fumosum *Pk.*
Linum medium (*Planch.*) *Britton*
Marasmius phyllophilus *Pk.*

Mycena albogrisea *Pk.*
Nicandra physaloides *Gaertn.*
Ohleria modesta *Fckl.*
Omphalia pusillissima *Pk.*
Panicum deminutivum *Pk.*
Peckiella hymenii *Pk.*
Phyllosticta ampelopsidis *E. & M.*
P. smilacis *E. & E.*
P. sphaeropsidea *E. & E.*
Pleurotus terrestris *Pk.*
Polyporus galactinus *Berk.*
Puccinia peckii (*DeT.*) *Kell.*
Russula foetentula *Pk.*
R. modesta *Pk.*
R. pectinatoides *Pk.*
R. vesca *Fr.*
Scleroderma tenerum *B. & C.*
Septoria lycopersici *Speg.*
Steccherinum adustulum *Banker*
Stemonitis smithii *Macb.*
Tricholoma hirtellum *Pk.*
Viola incognita *Brainerd*

*Not new to the herbarium*

Agastache scrophulariaefolia (*Willd.*)
Amanitopsis volvata (*Pk.*) *Sacc.*
Aquilegia canadensis *L.*
Arctium lappa *L.*
Asarum canadense *L.*
Aster camptilis *Bu.*
A. claytoni *Bu.*
A. concolor *L.*
Boletus auriporus *Pk.*
B. frostii *Russ.*
B. nigrellus *Pk.*
B. peckii *Frost*
B. rugosiceps *Pk.*
Bromus tectorum *L.*
Castanea dentata (*Marsh.*) *Borkh.*
Catastoma circumscissum (*B. & C.*)
Chrysomyxa pyrolae (*DC.*) *Rostr.*
Chrysopsis mariana *Nutt.*
Clavaria botrytoides *Pk.*
C. cristata *Pers.*
Clitocybe amethystina (*Bolt.*)
C. monadelpha *Morg.*
C. ochropurpurea *Berk.*
Clitopilus prunulus (*Scop.*) *Fr.*
Coreopsis rosea *Nutt.*
Cornus alternifolia *L. f.*
C. candidissima *Marsh.*
Crataegus caesariata *Sarg.*
C. coccinea *L.*
C. ferentaria *Sarg.*
C. illuminata *Sarg.*
C. intricata *Lange*
C. laneyi *Sarg.*
C. pedicellata *Sarg.*
C. pringlei *Sarg.*
C. punctata *Jacq.*
C. spissiflora *Sarg.*
C. tenuiloba *Sarg.*
Craterellus cantharellus (*Schw.*)
Cypripedium acaule *Ait.*
Daedalea quercina (*L.*) *Pers.*
Dasystoma virginica (*L.*) *Britt.*
Dryopteris boottii (*Tuck.*) *Und.*
D. cristata (*L.*) *Gray*
D. crist. clintoniana (*Eat.*)
D. simulata *Dav.*
Eleocharis inter. habereri *Fern.*
E. melanocarpa *Torr.*
Gentiana crinita *Froel.*
Hydnum aurantiacum *A. & S.*
H. fennicum (*Karst.*) *Sacc.*
H. imbricatum *L.*
H. repandum *L.*
H. vellereum *Pk.*
H. zonatum *Batsch*
Hypopitys lanuginosa (*Mx.*) *Nutt.*
Ilex vert. cyclophylla *Robins.*
Inocybe calamistrata *Fr.*
Irpex canescens *Fr.*
Lactarius ful. fumosus *Pk.*
L. pergamenus *Fr.*
L. piperatus *Fr.*
L. vellereus *Fr.*
L. volemus *Fr.*
Lespedeza angustifolia *Pursh*
L. hirta (*L.*) *Britt.*
L. virginica (*L.*)
Lobelia dortmanna *L.*
Lycopus sessilifolius *Gray*
Meibomia marilandica (*L.*) *Kuntze*
M. rigida (*Ell.*) *Kuntze*
Monarda punctata *L.*
Mycena galericulata (*Scop.*)
Physarum lateritium (*B. & R.*)
Polyporus schweinitzii *Fr.*
P. sulphureus (*Bull.*)
Polystichum acrostichoides (*Mx.*)
Polystictus simillimus *Pk.*
P. subsericeus *Pk.*
Populus balsamifera *L.*
Russula earlei *Pk.*
Sagina procumbens *L.*
Scirpus atro. pycnocephalus *Fern.*
S. cyp. pelius *Fern.*
Senecio obovatus *Muhl.*
Solidago tenuifolia *Pursh*
Sporobolus serotinus (*Torr.*) *Gray*
Stereum versicolor *Fr.*
Strobilomyces strobilaceus (*Scop.*)
Trillium erect. album *Pursh*
Tricholoma alboflavidum *Pk.*
T. nudum (*Bull.*) *Fr.*
Viburnum lentago *L.*
Viola blanda *Willd.*
V. cucullata *Ait.*
V. fimbriatula *Sm.*
Woodwardia areolata (*L.*) *Moore*

# IV

## REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports that the season of 1906 has been marked by relatively few extensive depredations by insects pests. This is particularly true of the forms affecting garden, vegetable and other common farm crops. A remarkable large South American moth (Thysania zenobia Cramer) was taken in Albany the last of September. This magnificient moth has a wing spread of about 5 inches and its occurrence in this city is undoubtedly due to its having been brought north with a boat load of bananas or other tropical fruit. This capture is an example of the way in which insects are distributed through commercial agencies, though in the present instance it happens to be a species which can not sustain itself in this latitude.

**Fruit tree insects.** The San José scale is still regarded as a serious pest of the horticulturist though the experience of recent years has demonstrated beyond question the practicability of keeping this insect in check by thorough and timely applications of a lime-sulfur wash. Our experiments conducted during a series of years show this insecticide to be fully as satisfactory as any other material which has been employed, despite the fact that a number of new preparations have been put on the market in recent years. These latter, though they possess certain very desirable qualities, have not been tested sufficiently so that they can be recommended without qualification.

We find the grape root worm still abundant in the Chautauqua region and the present indications are that some vineyards may be seriously injured by its depredations within a year or two. This insect, as experience has shown, is more or less local in its operations and general predictions regarding its work are in most cases rather hazardous.

**Shade tree problem.** This phase of practical entomology has made considerable demands upon our time in the last few years. This has been due in large part to extensive defoliations of street and park trees in many cities and villages of the State by the white marked tussock moth, a species which rarely occurs in destructive numbers outside of municipalities and villages, and one easily controlled by intelligent effort. The elm leaf beetle has been particularly destructive in the Hudson valley and has become established in cities and villages in other portions of the State. The work of these

leaf feeders and their allies has created a great demand for information along these lines. A number of popular articles have been sent to the local press in various parts of the State, urging the adoption of comprehensive measures for the protection of trees. It is gratifying to state that considerable interest has been aroused and most commendable efforts made to protect the trees. This plan, if carried out, provides for the protection of the trees from year to year — something which we have been advocating for some time, and it is hoped that cities and villages will adopt the measures recommended. A special bulletin, treating of the elm leaf beetle and white marked tussock moth and giving summary accounts of each, has been prepared and will be issued shortly. More extended accounts of these and other insect enemies of shade trees are given in our recent publication on *Insects Affecting Park and Woodland Trees* [N. Y. State Mus. mem. 8], a quarto work of two volumes comprising about 1000 pages, illustrated by 72 plates (20 colored), and over 200 text figures.

**Gipsy and brown tail moths.** These two dangerous insects, thoroughly and widely established in eastern New England, have been the objects of considerable attention here. The gipsy moth in particular is a most dangerous leaf feeder and has excited much interest. Owing to the fact that this latter species has been very destructive in eastern Massachusetts and is still extending its range, it was deemed wise to distribute in many sections of the State a warning placard briefly describing the insect and the associated brown tail moth. The latter displays a marked preference for fruit trees and is very annoying on account of the intense irritation produced by the urticating hairs of the caterpillar. The placard was supplemented by a bulletin [N. Y. State Mus. bul. 103] giving more detailed information concerning these pests, with the result that many specimens of various insects were sent to the office for determination. The newspapers of the State cooperated most efficiently in disseminating information relating to these dangerous forms.

It is gratifying to state that, so far as we have been able to discover, there is no ground for believing that either the gipsy moth or its destructive associate, the brown tail moth, has become established anywhere in New York State, though it would not be surprising were one or both of them to obtain a foothold in the near future. It is very important that our citizens should know about the gipsy moth in particular and be prepared to suppress the pest upon its first appearance.

**Aquatic insects.** The earlier investigations of this group have been continued. Dr James G. Needham has an extensive monograph on the stone flies (Plecoptera) nearly completed and this work will prove a valuable addition to our knowledge of a hitherto much neglected group. Dr Cornelius Betten, who has been giving special attention to the Caddis flies (Trichoptera) for the past five years, continued his studies last summer at Buffalo and Ogdensburg. These insects are an important element of fish food and, in addition, are of considerable local significance in the city of Buffalo. They breed in such large numbers in the rapids of the Niagara river that each summer the adults belonging to this group and the not distantly related May flies (Ephemeridae) swarm by millions in portions of the city near the river front. The insects are so abundant as to prohibit outdoor painting during certain portions of the season. These flies were one of the factors which led to the locating of the Pan-American Exposition some distance from their breeding places. Dr Betten has given particular attention to this local phase of the problem and he is now engaged in preparing an exhaustive account of this very interesting and in some respects important group.

**Gall midges.** These minute, inconspicuous insects, belonging to a family comprising a large number of species, have been subjects of careful and extensive investigations by the Entomologist and his assistants. Certain forms, like the Hessian fly and wheat midge, are of prime economic importance. The former is well known as an exceedingly destructive enemy of certain varieties of wheat, and in 1901 caused an estimated loss in New York State alone of $3,000,000. The wheat midge in earlier years was also very destructive to this important grain crop. During the last decade another member of this family, the violet gall midge, has become a dangerous enemy of the extensive violet-growing industry, which has its most important center at Rhinebeck, N. Y. The members of this group are better known because of the many remarkable vegetable deformities they produce, and the adult insects present some interesting morphological variations. The continued and thorough collecting during the summer has resulted in the accumulation of a large amount of material. A recent catalogue lists less than 150 species as being native to North America, whereas our recent work has resulted in finding in New York State alone probably over 400 species, including therein representatives of genera hitherto unrecognized in this country, and presumably of others unknown.

Mr J. R. Gillett, a medical student, was engaged during the entire summer in making some 2000 microscopic preparations of these insects. These large additions to our collection will result in important contributions to our knowledge of this hitherto relatively unknown group. The value of this work has been greatly increased by the enthusiastic and intelligent collecting of Assistant Entomologist Young and Assistant Nixon.

**Publications.** The Entomologist has contributed numerous economic articles to the agricultural and local press. The report of the office for 1904, owing to delays, did not appear till early in the present fiscal year, and that for 1905 was not issued until September, 1906. A special bulletin giving a summary account of the gipsy and brown tail moths [Mus. bul. 103] was issued in midsummer, and the first volume of *Insects Affecting Park and Woodland Trees* [Mus. mem. 8] appeared in February; the second volume of this work will appear without delay.

Another paper entitled *Diversities among New York Mosquitos* was reprinted from the Yearbook for 1904–5 of the American Mosquito Extermination Society.

**Collections.** Considerable additions have been made to the State collections aside from those secured in prosecuting the special investigations mentioned above. A fine collection of parasitic wasps (Chrysididae) was received from A. Mocsary, Budapest, and a valuable addition to the Tachina flies from Dr Mario Bezzi of Torino, Italy. Some desirable mosquitos from the south and southwestern part of this country, from Jamaica and the Philippine Islands were obtained through various correspondents of the office.

The special collections made by the members of the office staff in the Cecidomyiidae, mentioned above, have resulted in large additions to this group. The work upon the State collections has continued with unabated vigor and the general condition of the collections has been much improved, particularly in the families Ortalidae, Trypetidae, Dolichopodidae and Ephydridae. The representatives of the latter groups have been determined by the Assistant Entomologist. The midges (Chironomidae) have received considerable study at the hands of Assistant I. L. Nixon, who has also devoted much time to the general arrangement and classification of the Coleoptera.

## V

## REPORT ON THE ZOOLOGY SECTION

The Zoologist assumed his duties on May 21. He found the collections in a somewhat unsettled state, owing in part to the sudden termination, caused by death, of rearrangements undertaken by his predecessor, and in part to the crowded conditions in Geological Hall resulting from recent encroachments by other State departments. A careful study has been made of these collections, with a view particularly to their possibilities of development in the new building.

The mounted birds have received much attention in the past and are probably in as good shape as any part of the exhibit. A portion of the series which had been disarranged will soon be restored to order. This collection is now thoroughly card-catalogued, but it is unfortunate that the specimens belonging to the old State collection are mostly deficient in requisite data. The style of standard and label in use being unsuited to present needs, an effort is being made to devise a superior mount.

In response to public demand the foreign birds (mostly of the De Rham collection) have been taken from storage and returned to the cases. They will later be given a more satisfactory installation.

The study series of bird skins, inaugurated last year, is rapidly outgrowing the quarters assigned to it.

The representation of the New York avifauna has been increased during the year by 20 species and about 30 sexes or phases of plumage new to the collection, besides several New York specimens of species hitherto represented only by extralimital examples. After correcting some misidentifications in the old material, this leaves 34 species (8½ per cent) of the birds reported from our State unrepresented in the Museum, together with 9 species of the hypothetic list. [Since October 1st about half of these missing species have been obtained and will be reported upon next year.] The added material has been chiefly in the form of skins, to conform to present space limitations.

Four new cases of birds mounted by the Taxidermist have been installed in the exhibition hall. These contain family groups of little green heron (Ardea virescens), Clapper rail (Ral-

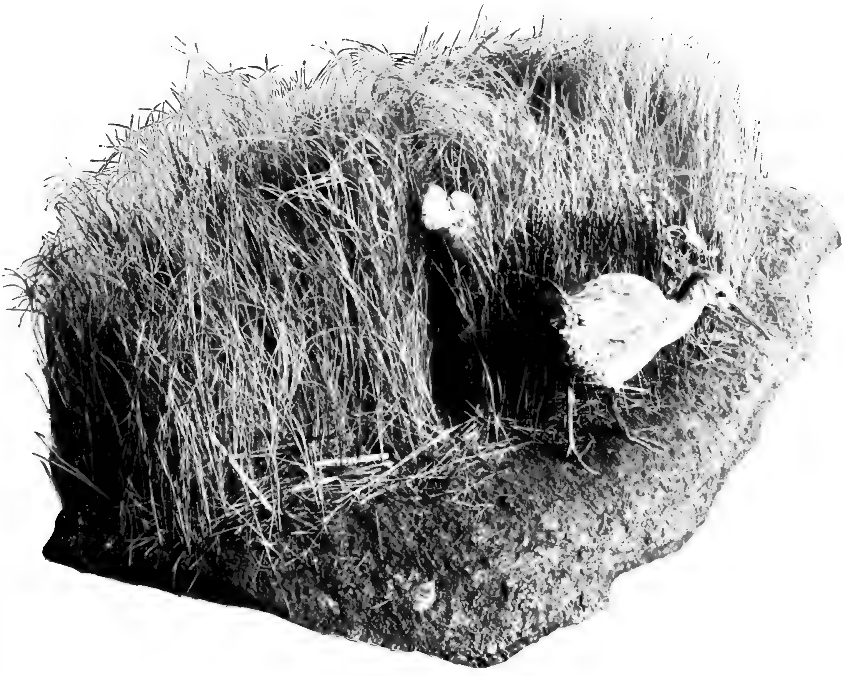
Plate 20

RECENT BIRD GROUP

Green heron

Ardea virescens (Linné)

Plate 21



RECENT BIRD GROUP

Clapper rail

Rallus crepitans (Gmelin)

Plate 22

RECENT BIRD GROUP

Slate-colored junco

Junco hiemalis (Linné)

lus crepitans), slate-colored junco (Junco hiemalis) and Cedar waxwing (Ampelis cedrorum). The heron and rail groups are larger than those previously attempted and are displayed in "all-glass" cases, an experiment which is not proving wholly successful as the cases admit moisture.

It is to be regretted that the unique collection of mounted poultry was forced out of exhibition during the winter to accommodate the agricultural offices, as there is a constant demand from visitors to be shown the collection.

The monograph of the *Birds of New York* has progressed satisfactorily. During the past year a tabulation of all available information regarding the birds of the State has been completed. This includes the 22 books and local lists of New York birds which are especially noteworthy, as well as the reports from about 100 observers in the different counties of the State. This work which was regarded practically completed a year ago, it has been necessary to entirely review on account of the unreliability of some of the reports previously tabulated and the acquisition of new knowledge. These tables, it is believed, are now wholly reliable and furnish an exhaustive account of the distribution of the birds in all parts of the State. A study of the faunal areas of New York has been completed and maps prepared showing the distribution of the most interesting Boreal and Carolinian species. The descriptive text has been prepared for a large part of the water birds. At the rate the work is moving, the first half should be completed within the present year. Besides the paintings by Mr L. A. Fuertes, many photographs have been secured illustrating life histories or nesting habits and also some of the rare or unique specimens which have been taken in the State. That portion of the work, however, which has consumed the most time and yet makes the least showing is the sifting or investigation of reports of rare birds taken in the State. The number of New York species now reaches 400 with several reports still in doubt.

The collection of mounted *Mammals* stands essentially as when last reported. It is card-catalogued in the same manner as the birds. A few specimens have been replaced during the year by fresh mounts, and the group of red fox illustrated in last year's report has been placed on exhibition on the fourth floor, where it is now the center of attraction. Similar groups of other mammals are contemplated.

The exhibit of *Reptiles* and *Batrachians* has received little attention during the year. It consists largely of the handsome Ward casts, a series which it may be well to extend. It is desirable also to display a larger number of species mounted in spirits when these can be prepared and space is available.

The *Fish* series exhibited likewise consists largely of Ward casts. It is proposed to eventually remove these from the plaster panels and hang them directly against an appropriate background. Additional casts, if purchased, should therefore be unframed. The matter of supplying fishes mounted in an approved manner to replace our few and superannuated specimens has been taken up with an experienced man. Experiments are also being made with an advanced method of mounting the fishes now very unsatisfactorily displayed in cylindrical jars. No additions to the fish collection were made during the year.

The reptiles, batrachians and fishes are card-catalogued.

The exhibition collection of *Invertebrates,* with the exception of the Mollusca, needs to be much expanded, as the alcoholic mounts of arthropods, echinoderms, coelenterates and sponges hardly constitute a fair representation of our State fauna. Another season's collecting on the coast will help to remedy this. The State series of shells needs to be relabeled and rearranged according to the new classification of Pilsbry, Simpson and Dall, while the reinstallation of the general exhibit (Gould collection) attempted several years ago remains unfinished, there being a gap in the classification with certain families in storage. To complete this will require considerable labor, but as the shell collection is one of the largest and most popular displays it is desirable that it be undertaken soon.

Progress has been made in the preparation of a Monograph of the *New York Mollusca.* This field is a broad one and appeals to a considerable body of the scientific public but the plan to bring together the sum of our knowledge of these widespread and interesting animals involves laborious and patient work which may not have its fruitage for some years.

The synoptical collection commenced by the late Dr Paulmier has been withdrawn from exhibition, on account of its fragmentary appearance, until such time as it can be filled out and prepared for installation in the manner intended by its designer.

An incomplete card catalogue of invertebrates covers chiefly, though but partially, material of rather recent acquisition. This is being rapidly extended and expanded. It is hoped that by another

year the zoological collections of the Museum will be completely inventoried and classified in the most convenient and practical form.

For special study, preparatory to a report, the Zoologist has taken up the spiders, of which he has prepared a check list of 470 species (now increased to 489) recorded from the State or immediately surrounding territory. A large amount of material has been collected or received through voluntary helpers, and enlarged watercolor sketches of fresh specimens have been made by a competent artist, before their colors were affected by the preserving fluids.

The sketches and notes made by Dr Paulmier for a monograph of the myriapods are being treasured until an opportunity offers for the completion of his work. The large collection of specimens of this difficult group has also been assembled preparatory to study.

A check list of the echinoderms of the State and adjacent waters is being drawn up, as these forms have been neglected in the State publications and an illustrated report upon them is desirable.

Among matters of general interest may be mentioned the unusual abundance of the huge polyzoan, Pectinatella magnifica, in some of our streams this fall. As this raises important questions of its sanitary effect on drinking water and ice, it is hoped to investigate these growths in the field another year.

A driven well at Olean has furnished specimens of the blind cave shrimp, Crangonyx tenuis, apparently from a gravel stratum between 20 and 30 feet underground. The species has been previously obtained from Howe's cave.

Other unusual records are a "black woodchuck" from Fayetteville agreeing exactly with De Kay's description [N. Y. State Nat. Hist., Mammals, p. 69, "No. 2"] and from a point near De Kay's locality; a Florida "chameleon" captured alive in an Albany express office; and a southern spider, Heteropoda venatoria, also caught in Albany.

## VI

## REPORT ON THE ARCHEOLOGY SECTION

Field work in archeology for the season of 1906 began on May 1. A month's time was expended in making preliminary examinations of various sites of prehistoric and recent aboriginal occupation in the counties of Ontario, Livingston, Monroe, Genesee, Erie, Cattaraugus and Chautauqua. With the exception of the region west

of a meridian line through Chautauqua lake, most of the described territory has been the field of archeologic research for many years and the State Museum archeological collections have representative specimens from it. Western Chautauqua, however, is a practically unexplored region and presents an exceptionally inviting field for investigation, being the borderland between the territory of the tribes of Iroquoian stock and the culture area of that mysterious people for the sake of convenience termed "mound builders." An examination of this region revealed a surprising number of sites that proved to be rich in relics of old Erie occupations, and in view of the fact that the State Museum had few or no relics of the Eries, and, indeed, as very little was known of them, one of these sites was chosen as the field for the season's operations and a leasehold was obtained.

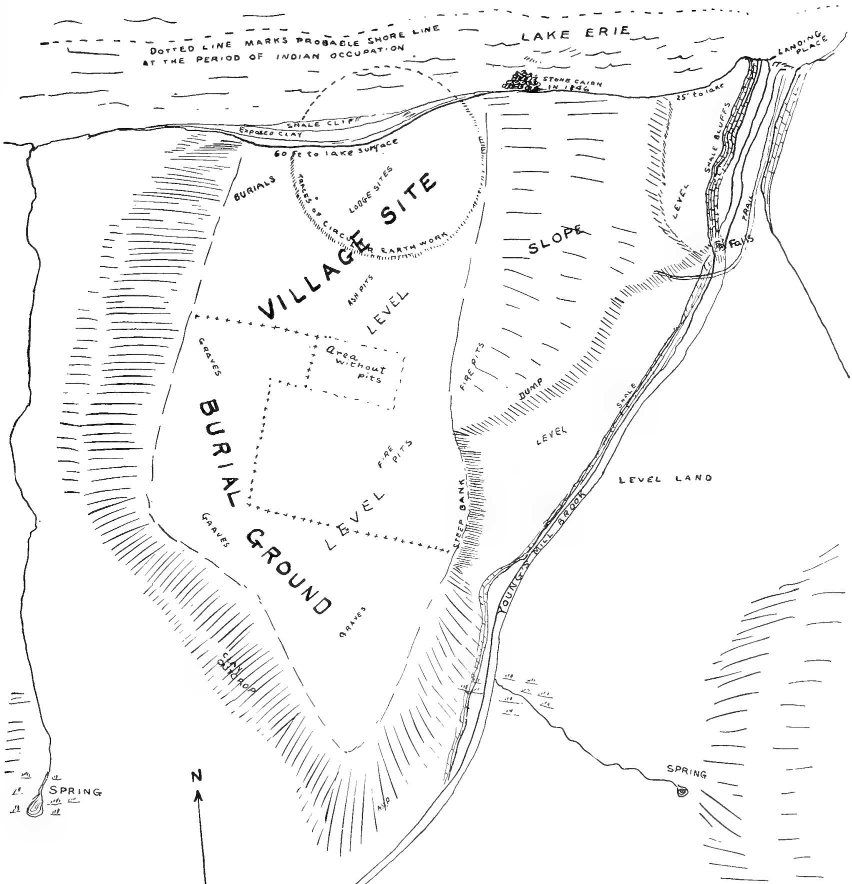
## Ripley site

This site is situated on the Young farm in lot 27, Ripley, Chautauqua co. It covers an elevation locally known as "Dewey knoll" situated on the bluffs of Lake Erie. On the east a stream has cut through the shale and eaten down the bluffs to the lake level so that a landing is easily effected from the water. This landing is one of the few between Barcelona harbor and the mouth of Twenty-mile creek in Pennsylvania, where there is easy access to the land on the bluffs above. The stream has cut the east side of the knoll so that for several hundred feet south from the lake the bank rises steep and in places almost sheer from the creek bed. The place is one, therefore, naturally adapted for a fortified refuge and must have been an attractive spot for the aborigines who built upon it a circular earthwork and a village and who found in the loose sand a most suitable place for the burial of their dead.

Excavations were commenced on June 1 and carried on until October 1. Parallel and adjacent trenches 16 feet wide were staked and the excavations run as far as indications of occupancy extended. In this manner every cubic inch of soil covered by the trenches and exhibiting signs of disturbance by human hands was examined and the numerous relics left by the former occupants were discovered. The site was divided in two sections, the village and the burial.

**The burial section.** An examination of 100 graves disclosed that all bodies had been buried in a flexed position, that is, on one side with the knees drawn well up toward the chin with one hand placed under or near the head, in fact such a position as would

Plate 23




Map of Dewey's knoll on the William Young farm, Ripley, Chautauqua co.; the site of an ancient Erie Indian fort, village and burial ground

be assumed in sleeping. The head was placed toward no particular cardinal point although in the majority of cases the face was turned toward the east or west and rarely to the south. The majority of skeletons were those of mature adults although there were a few infants and young adults.

Field measurements of the bones indicate that the race was one of medium hight, 5 feet, 7 or 8 inches, perhaps being the average. A few skeletons were found that approached 6 feet. That the race was stocky is shown by the heavy development of muscular ridges, especially in the case of males whose bones were large.

The loose sand affording good drainage preserved the bones when they were not buried directly upon the clay stratum, but in either case by the shifting of the sand or through some other agency, most of the skulls were broken or crushed while other bones were in a much better state of preservation. Some of the complete skulls obtained are of exceptional interest. In form, all are either dolichocephalic or subdolichocephalic, none being of the brachycephalic type common to the regions of the "mound builder" culture 100 miles west. A large percentage of skulls from Erie sites, 30 miles east are characterized by aveolar prognathism, but among the 100 from the Ripley site, only two were found with this development. The *os incae* was observed in a few cases and also instances of wormian bones in pairs. In one skull, the *os japonicum*, that is the lower portion of a malar bone when divided by a suture, was noted. The skulls are mostly of a high type, the average capacity being 1587 cubic centimeters for males and 1440 for females. The average cephalic index would be perhaps 74.5, and the nasal index 47. A careful study of all the morphological characteristics will be made in the laboratory and reported in another place and may slightly modify the averages here given. In a few cases humeri were observed in which the olecranon cavity was perforated. In two instances an examination of the femur revealed the processes termed the third trochanter and hypotrochanteric fossa.

With the exception of two cases of ankylosis, no pathological conditions were noted. There are a number of bones, however, that indicate the repair of a breakage.

Only in a few cases were possible clues to the cause of death discovered. In several skeletons triangular arrowheads were found between the vertebrae and in other parts of the osseous structure. A remarkable form of ankylosis was observed in the case of an aged male whose entire spine had become cemented into one solid

bone. One low type female skull marked by prognathism and wormian bones has the frontal bone crushed, depressed and a perforation filled by osseous matter.

The graves were from 12 inches to 70 inches below the surface of the ground, but eliminating these extremes, 42 inches would be the average. The graves seem to have been lined with bark which in some instances was charred owing to the custom of building a fire in the grave to drive out the dampness and "warm the bed" in which the sleeper must rest so long. In other Erie graves elsewhere fire pits are almost without exception found in the top soil above. These are the remains of the ceremonial watch and feast fires that were customarily burned for 10 days. Here, however, only one out of 10 graves had the watch fire pit above. Perhaps 50 years of plowing had obliterated the shallow pits. In some places the burials were crowded together, some almost intruding on others.

The most valuable and interesting objects found by the expedition were discovered in the graves and include terra cotta vessels of various forms and ornamentation, pipes of the local clay or of stone, objects of shell, bone, chipped flint, polished stones, celts, bar celts and other articles. In several graves small pieces of iron were found, indicating European contact. Two graves yielded complete outfits for the manufacture of chipped flints, the stone hammers, anvils, flakers and pitching tools being together in one spot as if originally inclosed in a bag which afterward decayed. Where copper ornaments had been used the flesh, garment, or fabric in immediate contact with the copper or brass was preserved by the copper salts which were freed by natural agencies or by the acids formed by decomposition. In graves where copper was present, human flesh, skin, nails, hair and bones and animal skins, bark, wood, fabrics, vegetable matter, etc. were preserved by the copper. In one instance a lower arm incased by copper bands, each finger also being covered by a wide copper ring of native make, was almost entirely preserved by the copper salts. Upon exposure the flesh fell apart in strips baring the green copper-stained bone. The hair preserved by the copper is fine and black and the finger nails small and shapely.

The pottery vessels from the graves exhibit a wide range of forms, the old Iroquoian square top with raised corners, the southern cord-racked, and the pitcher-nosed being among the rarer forms. At least 20 pots are in absolutely perfect condition, 20 more have small breaks and perhaps 30 more are badly crushed, although

some may be restored. Because of the many unique features, the collection of pots may be regarded as the most remarkable ever taken from a single site in New York State.

Among the interesting products of the aboriginal Erie potter are six terra cotta pipes each differing in form from the other. Especially beautiful is a pipe having a bowl shaped like a human head with a delicately molded face on either side. Four carved stone pipes of unique forms were taken from the burials. The material of which they are made is foreign to the locality and seems to be trans-Mississippian. In the upper stratum of the soil above the ash pits, three other stone pipes were found, one a crude imitation in the local shale of the beak or claw pipe, and the other two, pipe bowls of the Wisconsin form.

A large number of polished, picked and rough edged stone celts were found, some of which are rare forms in New York.

Shell articles were not common, but one necklace of discoidal beads having two shell gorgets and a long pendant was found about the neck of an aged female. Flint objects were commonly found in graves especially those of males and include spears, knives, arrowheads of the triangular form, blank blades and chips. Black and red pigments were sometimes found in little deposits near the skulls.

**Pits in village site.** Fifty ash and refuse pits were opened in the village section of the site and yielded quantities of relics. The pits here were from 2 to 5 feet deep and in general had diameters equal to depths. The ash and carbonaceous matter in the pits, as is the case in all ash pits wherever found, preserved the bone and antler objects of which large numbers were found. Of the bone articles many beautiful ones were discovered, among which may be mentioned awls, beads, needles, shuttles, markers, balls, hooks, pendants, tubes and various objects the use of which is conjectural. The antler implements include spades, hoes, picks, punches, pitching tools, awls, flakers, pendants, chisels and scrapers. There were also scrapers made of beaver teeth and several kinds of perforated animal teeth found.

Stone objects were numerous, all the common types being represented.

Several pottery cups and thousands of pot fragments were taken from the pits. One sherd is particularly interesting from the fact that it is decorated with two parallel bands of brown on a background of orange. Whether this is an intentional decoration or an accident of baking is difficult to determine but if the color decora-

tion was purposely made it represents a development hitherto unknown in New York Indian pottery.

A few shell beads of native handiwork found in the pits are of the ordinary Iroquoian type.

Great quantities of animal bones, split and cracked for the marrow, were found in nearly all the ash pits. Of the animal bones identified the following is a list: beaver, bear, buffalo, elk, deer, raccoon, rabbit, woodchuck, skunk, fisher, squirrel, wildcat, porcupine, turtle, sturgeon, catfish, perch, billfish, mullet and pike.

Vegetable matter preserved by carbonization includes corn, nuts of various kinds, wood, grass, reeds and a section of a hollow pipe stem.

The thousands of specimens taken from the Ripley site form a most valuable accession to the Museum and represent the first successful effort to obtain a collection wholly by the research method, and by this method only may every scientific requirement be satisfied. Accurate and painstaking notes were made and scores of maps, diagrams, drawings and photographs were made to supplement the written descriptions. Every specimen was numbered in the field and a full description of the spot in which it was found, with all the circumstances, was filled in on a data slip. Every ash pit and grave may be mathematically charted on a map of the site made by a careful survey. Every important specimen was photographed exactly as found and all skeletons were carefully exposed and photographed before a bone was moved.

The rapidity with which the objects were found made it impossible to make a complete study in the field, but a full report of the important scientific results of the expedition will be embodied in a report to be published at a later date.

**Archeological collections acquired by purchase.** Since the last report three large collections of archeological material have been acquired. The first was obtained from Joseph E. Mattern of West Rush. It is especially valuable for the polished slate articles it contains as well as for the splendid series of stone and bone objects representative of the Genesee valley.

A collection of prehistoric Onondaga relics, a collection of relics from Algonkin fishing camps and a collection of objects similar to those of Eskimoan culture, from Jefferson county were purchased from Dr R. W. Amidon of Chaumont. These collections are most valuable for the bone objects of an ancient occupation, which they contain.

A collection of New York relics was also obtained from William A. Spear of North East, Pa. This comprises a large number of beautifully polished celts, slate gorgets, and highly polished articles of oolitic limestone. One of the notable specimens is a war club of curly maple which was found on the battlefield at Herkimer in 1791. It is one of the finest war clubs in the Museum. Another unique specimen in this collection is a wine press of stone, ingeniously wrought, found at Ripley.

During the early part of the year and up to June the Archeologist made several trips to the different Indian reservations and purchased a number of objects of ethnologic importance. These objects are the same in design and pattern as those of like character used two centuries ago and nearly all were found in actual use, a fact which illustrates the tenacity with which the Iroquois cling to their own culture.

The relics purchased include carved baby boards, ceremonial masks, wooden bowls, wooden ladles and spoons, ceremonial tom-toms, rattles, fans, baskets, sticks and poles, beaded blankets, strips, baby wrappings, leggings and skirts, silver brooches, earrings, dress ornaments and one silver crown. This crown or hat band is one of the largest made by the Iroquois and the last treasured insignia of the Tonawanda sachems.

**Tall Peter's crown.** Tall Peter the elder was one of the early chiefs of the Seneca-Iroquois.

In the memorable year, 1776, Noh-ka-ga-ah of the Turtle clan, or Tall Peter, as the white people afterward called him, was born in a bark lodge on the banks of the Cattaraugus, near Lake Erie. His mother's father had been a war chief, and he therefore was heir to the office. When he reached maturity the women nominated him and the warriors elected him war chief of the Senecas. It was then that his grandmother placed upon his head the crown which he afterward wore on all ceremonial occasions.

Ever since the advent of the white man up to within 25 years the democratic Iroquois have worn silver crowns and decorations. Money to them was an incomprehensible commodity; wampum was their medium of exchange. But to the savage everything had utility, so the New York savages hammered their silver into symbolic brooches and crowns.

With the increased influx of money and the depreciation of wampum a man's wealth was determined by the amount of silver he could fasten upon his buckskins, and it is a tradition that Tall Peter

could cover his broadcloth costume with brooches so thickly that he looked as if covered with the scales of a fish. Above this glittering suit, resting upon his raven locks was his crown, its curiously graven lines symbolizing his office.

Although still smarting under the effects of Sullivan's campaign, when the War of 1812 broke out the New York Indians offered their services to the United States. Some enlisted in the regular army, but most of them, many women, too, fought as allies. Tall Peter, being a war captain, donned his crown and led his company against the British. His shining crown made him the mark of hostile bullets, but he believed it a charm, for he emerged from the war without a scratch. He was discharged from the army in Buffalo.

Some of his compatriots had rather strange names and the roster of Indian veterans of the War of 1812 brings to light such names as Old Fish Hook, Tall Chief, Straight Back, George Washington, Corn Planter, Red Jacket, One Hundred, Two Guns, Twenty Canoes, Heap of Dogs and Devil's Ram Rod.

## VII

## PUBLICATIONS

A list of the scientific publications issued during the year 1905–6 with those now in press and treatises ready for printing is attached hereto. The publications issued are 15 in number on a variety of topics covering the whole range of our scientific activity. They embrace 2188 pages of text, 249 plates and 7 colored maps.

The labor of preparing this matter, verifying, editing and correcting is onerous and exacting. Taken together it excellently indicates the activity and diligence of the staff of this division.

### Annual report

1 2d Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1905. 102p.

*Contents:*

Plate 24

Pit 4, trench 3, Ripley. Looking directly down into the grave. The bones had almost entirely crumbled, a part of the skull and a portion of the femur only remaining. With the skeleton was a pottery vessel.

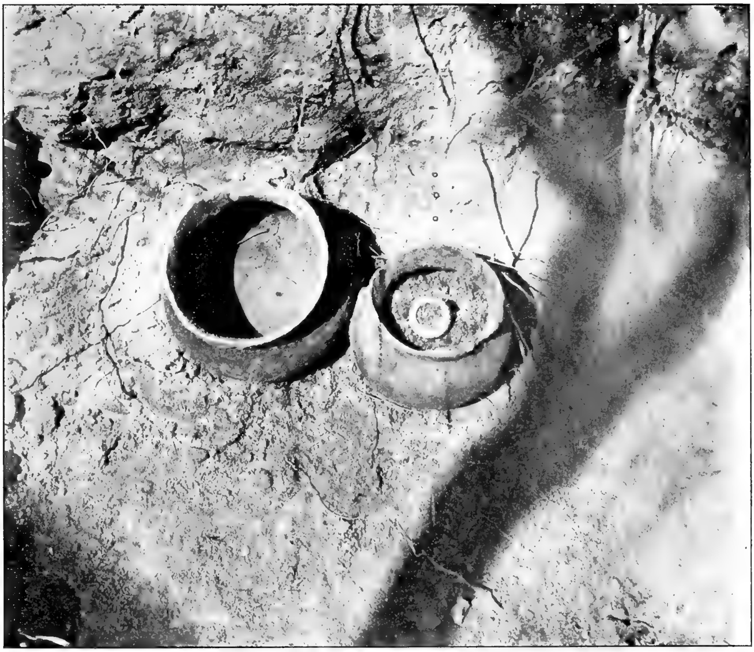
Plate 25

Grave pit 9, trench 3, Ripley. This grave contained the crumbling skeleton of an adult male. With the skeleton at the place indicated by the photograph was found a pipe of a most peculiar form [*see* pl. 33, fig. 1].

Plate 26

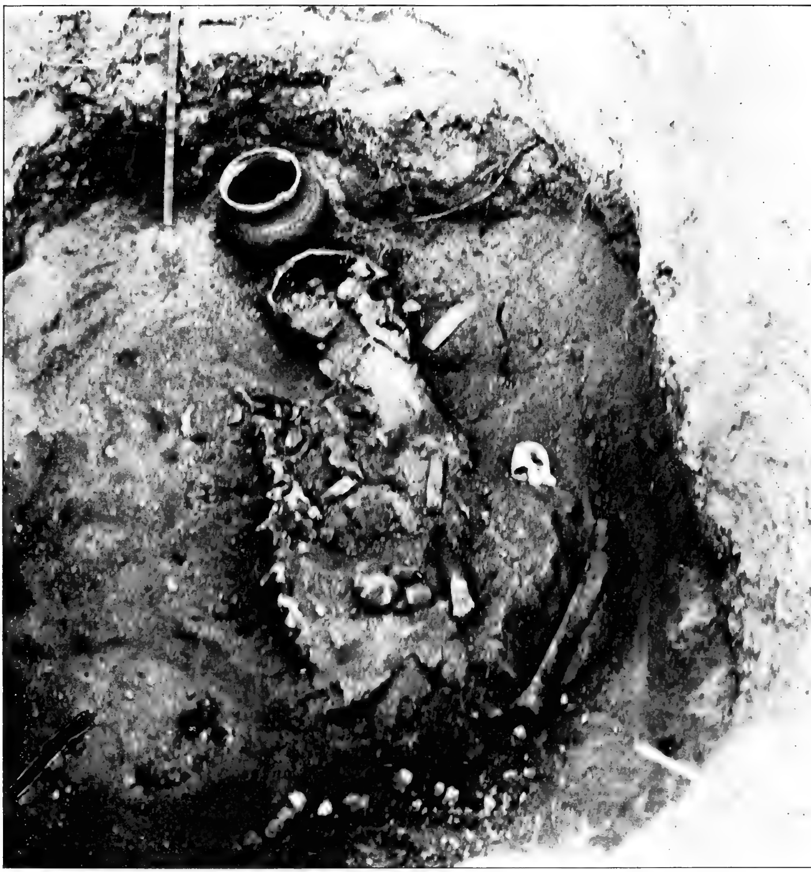
Grave pit 44, Ripley. This grave was 49″ below the surface, the dimensions of the excavation being 5′ 6″ x 6′. It contained the remains of an adult male of mature years. The face of the skull was turned toward the west and the top of the head to the south. The skeleton lay on its left side. Above the skull in the position indicated by the photograph was a most unusual pipe molded from the local clay [*see* pl. 33, fig. 2]. Januslike, this pipe has a face on either side and is one of the finest representations of the human face seen on any Iroquoian pottery. Above the skull were the inferior and superior maxillae of a young Ursus americanus, probably all that remains of a bear skin head or shoulder robe. There was much charred wood in the bottom of the grave. The bones of the skeleton were badly decayed but were removed. The skull was in a very poor condition and of little value. The hight of the individual, judging by the measurements of the bones, would approximate 5′ 7″.

Plate 27



Pit 62 at 33′ in trench 10 contained the molar teeth of a child of 12 years. The excavation was probably a grave although no other osseous matter beyond the teeth was found. In the grave were two pottery vessels as shown in the photograph. One of the vessels is of an unusual form and contains a large quantity of charred tobacco ashes and the bowl of a terra cotta pipe. Ripley, N. Y.

Plate 28

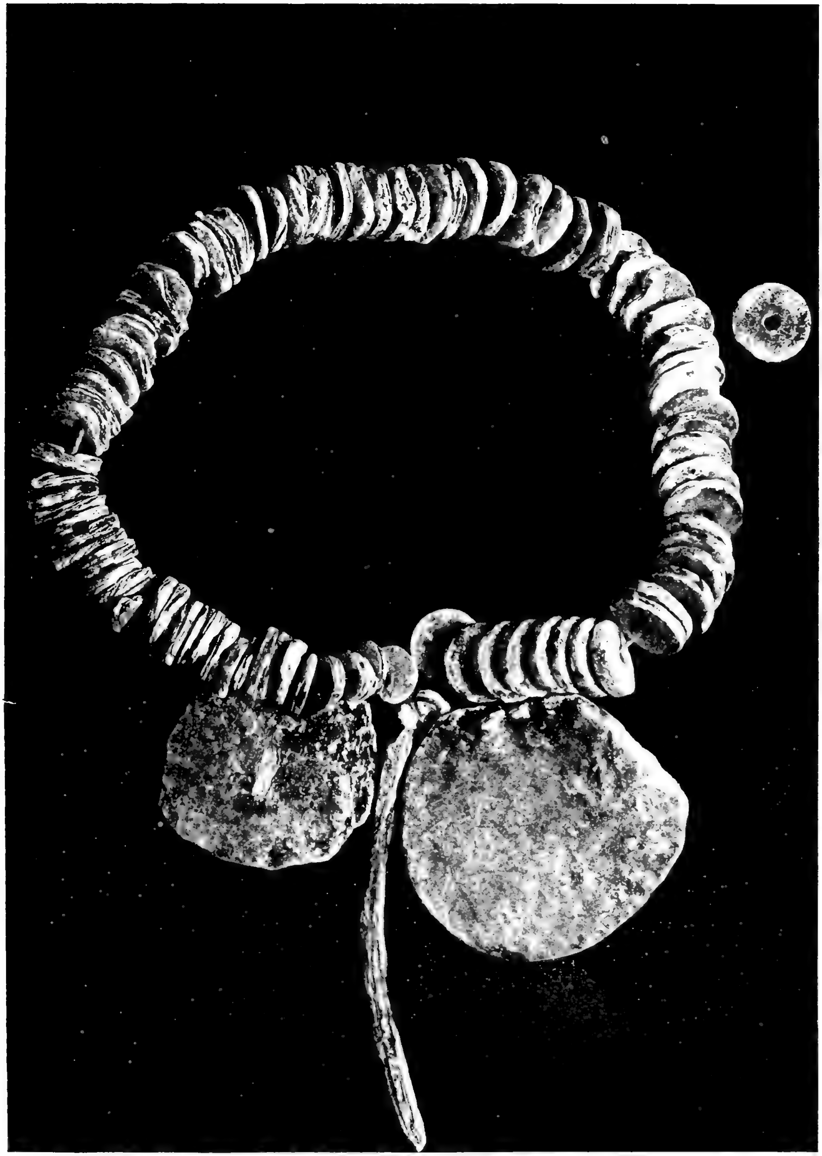


Grave pit 92, Ripley, at 84 feet in trench 10 was 3′ 4″ deep. It contained the decayed bones of an adult male of mature years. The spinal column was in one solid piece, the result of ankylosis. With the skeleton at the places indicated by the photograph were a double edged celt, a perfect pottery vessel, typically Erian, and a stone effigy pipe, representing some mythical animal [*see* pl. 33, fig. 3].

## Plate 29

Grave pit 96 at Ripley contained the skeleton of an aged female, the lower right arm of which was almost entirely preserved by the copper salts formed from the heavy copper arm bands and finger rings. Two infants' skeletons were found at her side and the skeleton of a headless male, near which was found one of the rarest of implements, a bar celt. Ten pottery vessels were buried in this family grave.

Plate 30



Necklace of shell disks found about the neck of a female skeleton, grave pit 133, trench 18, at 20′ on the west side. Ripley, N. Y. Restrung bead for bead as found.

## Plate 31

1

2

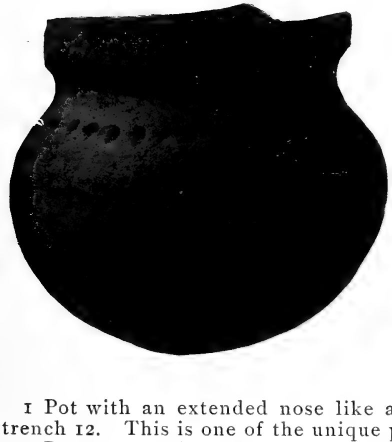
3

1 Terra cotta vessel from pit 92
2 Pottery vessel from pit 4, trench 3
3 Pot from grave pit 104
All from Ripley

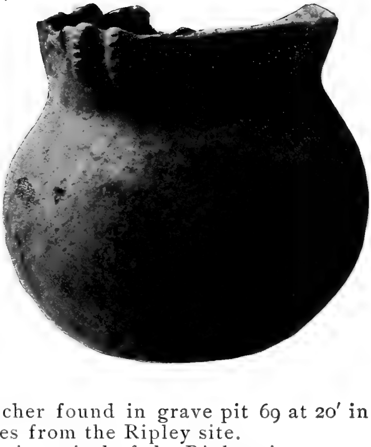
Plate 32

1

2



3



1 Pot with an extended nose like a pitcher found in grave pit 69 at 20′ in trench 12. This is one of the unique pieces from the Ripley site.
2 Pottery vessel 1 from pit 62. This pot is typical of the Ripley site.
3 Pottery vessel 2 from pit 62, Ripley. It was this pot that contained the tobacco ash and pipe. The rim ornament on the pot is unusual.

Plate 33

1

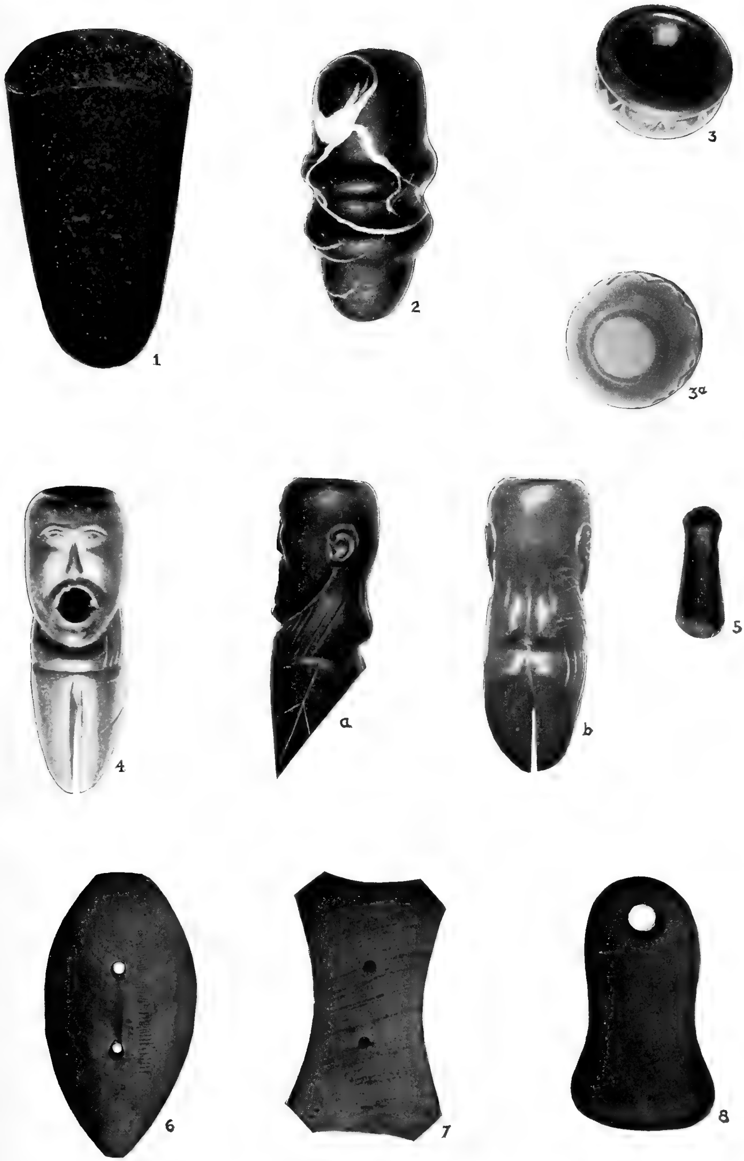
2

3

4

1 Terra cotta pipe from pit 9, trench 3. This pipe is unique in that it has a nipple over which a stem is designed to fit. In the ordinary pipe bowl the stem is inserted.
2 Terra cotta pipe from grave pit 44
3 Effigy pipe from grave 92
4 Double edged celt from grave 92
All from Ripley

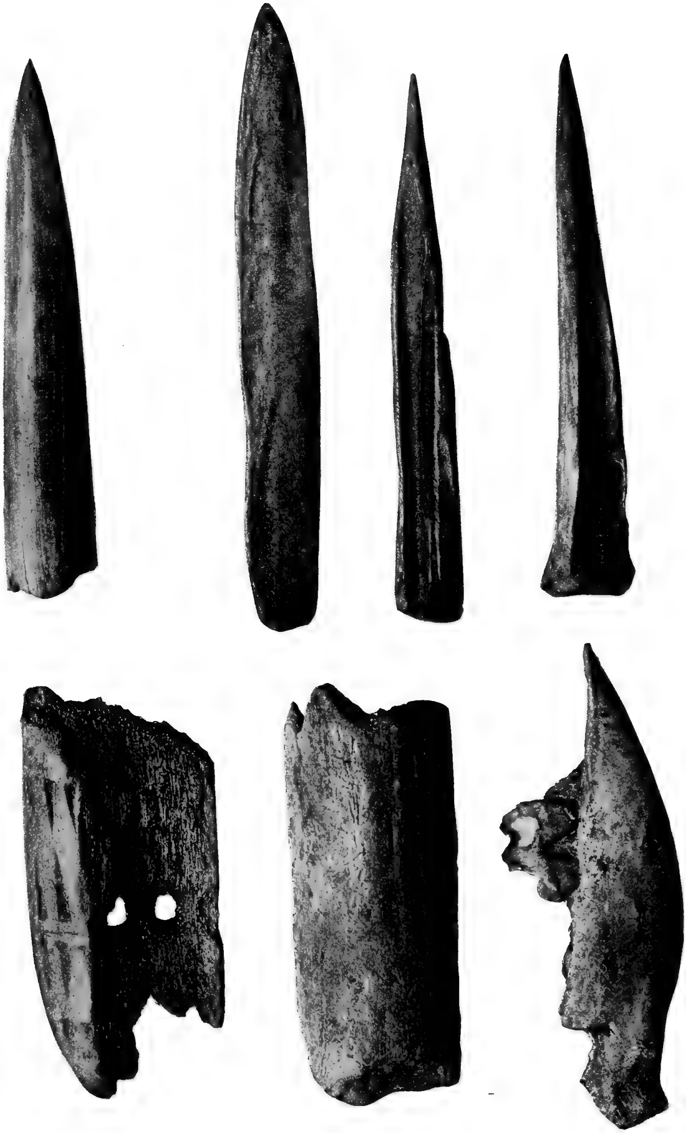
Plate 34




Polished stone objects from the William A. Spear collection:
1 Sharply beveled celt from vicinity of Findley lake
2 Highly polished war club head of marble
3 Polished cup of oolitic limestone. 3*a* view from bottom
4 Pipe bowl of oolitic limestone, 3 views
5 Small pestle or plummet
6–8 Gorgets from Findley lake

Implements of walrus ivory and bone from the R. W. Amidon collection, Jefferson county, N. Y.

Plate 36



Implements of bone and Ivory from Jefferson county. Many of the specimens in the R. W. Amidon collection, from which these objects are selected, show a marked similarity to those of the Eskimo.

Plate 37


Stone press for expressing juice from fruits and berries. This unique specimen is from the William A. Spear collection and was found at Ripley.

Plate 38

HERON FEATHER FANS

Used in the ceremonies of the Seneca Order of the Eagle, a native Indian fraternity of great antiquity. These fans belonged to Gaioyade the chanter of the Eagles, and a member of the Heron clan. Heron feather fans must always have six feathers but a fan of eagle feathers may have only four. A picture accompanying these specimens illustrated the use of the fans and rattles in the lodge ceremonies of the Eagles.

Obtained at Newton, Cattaraugus Reservation, near Lawtons Station, N. Y. March 30, 1906

Plate 39

Modern form of the old style Seneca headdress or Gus-to-weh.

This ceremonial headpiece was used by Chief Sai-no-wa, Inclined Post, in the Great Feather dance, in which ceremony he was one of the two chanters of the ritual. The chief, although he weighs 320 pounds, is an athlete of local fame, being an expert lacrosse player. He holds the unique record of having at the Pan-American Exposition caught a ball at the goal which he was guarding and throwing it across the field into the goal opposite. The admiring tribesmen of Sainowa say the big chief has big medicine.

Plate 40

Tall Peter's silver crown, the last treasured crown of the Tonawanda sachems.

## Memoirs

2 No. 8 Insects Affecting Park and Woodland Trees. By E. P. Felt. v. 1, 460p. 48pl.

*Contents:*



## Bulletins

### *Geology*

3 No. 95 Geology of the Northern Adirondack Region. By H. P. Cushing. 188p. 15pl. 3 maps.

*Contents:*



4 No. 96 Geology of the Paradox Lake Quadrangle. By I. H. Ogilvie. 54p. 17pl. map.

*Contents:*

## *Economic geology*

5 No. 100 Fire Tests of Some New York Building Stones. By W. E. McCourt. 40p. 26pl.

*Contents:*



6 No. 102 Mining and Quarry Industry of New York. 2d Report. By D. H. Newland. 162p.

*Contents:*



## *Mineralogy*

7 No. 98 Contributions from the Mineralogic Laboratory. By H. P. Whitlock. 38p. 7pl.

*Contents:*

*Paleontology*

8 No. 92 Guide to the Geology and Paleontology of the Schoharie Region. By A. W. Grabau. 316p. 24pl. map.

*Contents:*



9 No. 90 Cephalopoda of the Beekmantown and Chazy Formations of Champlain Basin. By Rudolph Ruedemann. 226p. 38pl.

*Contents:*



10 No. 99 Geology of the Buffalo Quadrangle. By D. D. Luther. 32p. map.

*Contents:*



11 No. 101 Geology of the Penn Yan-Hammondsport Quadrangles. By D. D. Luther. 28p. map.

*Contents:*

## *Entomology*

12 No. 97 Report of the State Entomologist for the fiscal year ending September 30, 1904. 246p. 19pl.

*Contents:*



13 No. 103 Gipsy and Brown Tail Moths. By E. P. Felt. 44p. 10pl.

*Contents:*



14 No. 104 21st Report of the State Entomologist for the fiscal year ending September 30, 1905. 144p. 10pl.

*Contents:*

*Botany*

15 No. 105 Report of the State Botanist for the fiscal year ending September 30, 1905. 108p. 12pl.

*Contents:*

Introduction
Species added to the herbarium
Contributors and their contributions
Species not before reported
Remarks and observations
Edible fungi
Species of Crataegus Found within Twenty Miles of Albany. C. S. SARGENT & C. H. PECK
Explanation of plates
Index

## Geological maps

16 Buffalo quadrangle
17 Penn Yan-Hammondsport quadrangles
18 Paradox Lake quadrangle
19 Portion of towns of Plattsburg and Peru, Clinton co.
20 Portion of towns of Chazy and Champlain, Clinton co.
21 Schoharie and Cobleskill valleys

IN PRESS

## Memoirs

22 Insects Affecting Park and Woodland Trees. v. 2
23 Early Devonic of Eastern North America
24 Devonic Fishes of the New York Formations

## Bulletins

*Geology and paleontology*

25 Geological Papers
26 Glacial Waters in the Lake Erie Basin
27 Drumlins of Central Western New York
28 Geology of the Long Lake Quadrangle
29 Geology of the Rochester and Ontario Beach Quadrangles

*Entomology*

30 White Marked Tussock Moth and Elm Leaf Beetle

*Archeology*

31 Aboriginal Place Names of New York
32 Civil, Religious and Mourning Councils and Ceremonies of Adoption

PREPARED

## Memoirs

Graptolites of New York. Pt 2, Graptolites of the Higher Beds

## Bulletins

*Geology and paleontology*

Later Glacial Waters in Central New York
Geology of the Morrisville Quadrangle

IN PREPARATION

## Bulletins

*Geology and paleontology*

Geology of the Theresa Quadrangle
Geology of the Highlands of the Hudson
Moraines of Western New York
Devonic Crinoids of New York
Devonic Plants of New York
Geology of the Auburn Quadrangle
Geology of the Portage-Nunda Quadrangles
Geology of the Genoa Quadrangle
Geology of the Geneva-Ovid Quadrangles
Geology of the Phelps Quadrangle
Geology of the Syracuse Quadrangle
Geology of Valcour Island
Geology of the Cazenovia Quadrangle

*Entomology*

Report of the State Entomologist for the fiscal year ending September 30, 1906
Monograph on Stone Flies
Monograph on Caddis Flies

*Botany*

Annual Report of the State Botanist for the fiscal year ending September 30, 1906

# VIII

## STAFF OF THE SCIENCE DIVISION AND STATE MUSEUM

The members of the staff, permanent and temporary, of this division as at present constituted are:

### ADMINISTRATION

John M. Clarke, *Director*
Jacob Van Deloo, *Director's clerk*

### GEOLOGY AND PALEONTOLOGY

John M. Clarke, *State Geologist and Paleontologist*
David H. Newland, *Assistant State Geologist*
Rudolf Ruedemann Ph.D., *Assistant State Paleontologist*
C. A. Hartnagel B.S., *Assistant in Economic Geology*
D. Dana Luther, *Field Geologist*
Herbert P. Whitlock C.E., *Mineralogist*
George S. Barkentin, *Draftsman*
William S. Barkentin, *Lithographer*
Joseph Morje, *First clerk*
H. C. Wardell, *Preparator*
C. A. Munger, *Stenographer*
George W. V. Spellacy, *Clerk*
Martin Sheehy, *Machinist*

### Temporary assistants

*Precambric geology*

Prof. H. P. Cushing, Adelbert College
Dr C. P. Berkey, Columbia University

*Stratigraphic geology*

Prof. T. C. Hopkins, Syracuse University
H. O. Whitnall, Colgate University
G. H. Hudson, Plattsburg State Normal School

*Geographic geology*

Prof. Herman L. Fairchild, Rochester University
Prof. J. B. Woodworth, Harvard University
Prof. A. P. Brigham, Colgate University

*Cave exploration*

John H. Cook, Albany
Harry Cook, Albany
John F. Loughran, Kingston

*Paleontology*

Dr C. R. Eastman, Harvard University
David White, United States Geological Survey
Dr T. Wayland Vaughan, United States Geological Survey
Edwin Kirk, Columbia University
Olof O. Nylander, Caribou, Me.

### BOTANY

Charles H. Peck M.A., *State Botanist*
Stewart H. Burnham, *Assistant,* Glens Falls.

### ENTOMOLOGY

Ephraim P. Felt B.S. D.Sc., *State Entomologist*
D. B. Young, *Assistant State Entomologist*
I. L. Nixon, *Assistant*
Anna M. Tolhurst, *Stenographer*
Howard C. Bain, *Page*

**Temporary assistants**

Dr James G. Needham, Lake Forest College
Cornelius Betten, Lake Forest College
John R. Gillett, Albany

### ZOOLOGY

George H. Chadwick, *Zoologist*
George L. Richard, *Taxidermist*

**Temporary assistants**

E. Howard Eaton, Canandaigua
Dr E. J. Letson, Buffalo

### ARCHEOLOGY

William M. Beauchamp S.T.D., *Archeologist*

**Temporary assistant**

Arthur C. Parker, Gowanda

**Maintenance.** The provision made by the Legislature of 1906 for the maintenance of the scientific work in all its branches and for the payment of all permanent and temporary services was $44,240.

# IX

## ACCESSIONS

### GEOLOGY

### Donation

| | |
|---|---|
| **Cole, Howard J.** New York city. Series of samples showing character and depth of clays, sands and bed rock encountered in excavating for the foundation of the John G. Myers Co. building, Albany | 8 |
| Samples of materials encountered in excavating for the foundation of the Trinity Annex building, New York city | 5 |
| **Lynch, Daniel.** Minerva. Serpentine marble, polished, 4″ by 6″ | 1 |

### Collection

| | |
|---|---|
| **Assistant State Geologist.** Zinc ore, Saratoga Springs | 1 |
| Zinc ore, Edwards, St Lawrence county | 5 |
| Iron ores and associated rocks from Adirondack districts, as follows: | |
| Benson Mines, St Lawrence county | 25 |
| Jayville, St Lawrence county | 4 |
| Clifton, St Lawrence county | 12 |
| Fort Ann, Washington county | 10 |
| Hammondville, Essex county | 33 |
| Crown Point, Essex county | 3 |
| Ticonderoga, Essex county | 3 |
| Lake Sanford, Essex county | 12 |
| Dannemora, Clinton county | 3 |
| Arnold Hill, Clinton county | 20 |
| **Assistant in Economic Geology.** Clinton iron ore and associated rocks as follows: | |
| Ontario, Wayne county | 6 |
| Sterling Station, Cayuga county | 6 |
| Verona, Oneida county | 3 |
| Clinton, Oneida county (lower oolitic bed) | 1 |
| Clinton, Oneida county (upper oolitic bed) | 10 |
| Clinton, Oneida county ("red flux" bed) | 3 |
| Clinton iron ore from base of upper Clinton sandstone, Henderson, Herkimer county | 3 |
| Clinton ferruginous sandstone, south of Frankfort, Herkimer county | 6 |
| Clinton upper sandstone, south of Mohawk, Herkimer county | 1 |
| Peridotite dike in Devonic rocks at Glenwood, Tompkins county | 3 |
| Arsenopyrite (mispickel) Carmel, Putnam county | 3 |
| "Hudson River shale," specimen of core from elevator shaft at depth of 128 feet below Pearl street curb, John G. Myers Co. building, Albany, N. Y | 1 |
| **Total** | 191 |

## PALEONTOLOGY

### Donation

**Hartnagel, C. A.** Albany. Guelph fossils from near Rochester.... 47
**Drevermann,** *Dr* **Fr.** Frankfurt, Germany. Fossils mostly Middle Devonic from Germany........................................ 195
**Derby, O. A. & Clarke, J. M.** Fossils including 120 types collected by Morgan expeditions in the Amazonas, Brazil................ 335

### Exchange

**Barroubio, Jean Miguel.** France. Fossils from various formations and localities in France........................................ 60

### Purchase

**Copi,** *Dr* **Fr.** Modena, France. Fossils from various formations in Sweden, England, Bohemia and France........................ 30
**Krantz,** *Dr* **F.** Bonn, Germany. Trilobites from various formations in Prussia, Norway, Bohemia and Russia; fossils from upper Carbonic, Grundy county, Illinois................................ 73
**Ward's Natural Science Establishment.** Rochester, N. Y. Trilobites from Ohio, South Dakota, Ontario, Can........................ 5
**Alden, H. J.** Cambridge, Mass. Fossil fish (Dinichthys pustulosus Eastman) from Oneonta sandstone, Delhi, N. Y.. 1

### Collection

**Assistant State Paleontologist.** Devonic fossils from vicinity of Lake Memphremagog, Canada ................................ 230
**Assistant State Paleontologist & Wardell, H. C.** Crustaceans from base of the Salina, "Spring House," near Pittsford, N. Y........ 275
**Field Geologist.** Portage and Genesee fossils from Tompkins county ................................................ 40
**Hartnagel, C. A.** Fossils from various formations................. 418
**Wardell, H. C.** Graptolites from Clinton beds, Genesee gorge, Rochester ................................................ 30
Crustaceans from Bertie waterlime, Jerusalem Hill, Herkimer county ................................................ 43
Crustaceans from Shawangunk grit, Otisville, Orange county...... 200
Fossils from the Helderbergian, Salisbury's quarry, North Litchfield, Herkimer county.................................... 125
Fossils from Rochester shale, Barge canal excavation, near Gates, Monroe county, N. Y.................................... 30
**Nylander, O. O.** Lower Devonic fossils from Washington county, Me. ................................................ 900

Total ................................................ 3037

### MINERALOGY

## Donation

**Hodge, *Capt.* R. S.** Antwerp. Goethite, Antwerp................ 1
**Cumings, W. L.** South Bethlehem, Pa. Pyroxene, Mineville...... 1
**Hartnagel, C. A.** Albany. Celestite and calcite, Rochester......... 1
**Hindshaw, H. H.** Albany. Tourmalin in oligoclase, Crown Point.. 2
Turgite, El Noel, Spain.............................................. 1
**Wardell, H. C.** Albany. Pyrite (nodules), Waterford.............. 3
**Wolf, William.** Waterford. Pyrite crystallized), Waterford....... 1
**Wait, C.** Crown Point. Apatite (eupychroite), Crown Point....... 7
**Van Deloo, J.** Albany. Calcite, Rossie.......................... 1
Garnet (crystals), North Adams, Mass.......................... 10
**Snyder, Grant.** Otisville, N. Y. Quartz, Otisville................. 4
**Woodworth, *Mrs* J. L.** Albany. Orthoclase and fluorite, Victor, Col. 1

## Exchange

**Cumings, W. L.** South Bethlehem, Pa. Zircon in oligoclase, Mineville ........................................................ 40

## Purchase

**Hodge, *Capt.* R. S.** Antwerp, N. Y. Millerite and garnierite, Antwerp ........................................................ 2
Millerite, Antwerp................................................ 23
Stilpnomelane (chalcodite), Antwerp............................ 20
Hematite (mammillary), Antwerp................................ 2
Hematite (specular), Antwerp................................... 25
Ankerite and dolomite, Antwerp................................. 21
Quartz and hematite, Antwerp................................... 9
Pyrite on dolomite, Antwerp..................................... 2
Goethite on quartz and dolomite, Antwerp...................... 8
Dolomite (large crystals), Antwerp............................. 1
Calcite and siderite, Antwerp................................... 1

## Collection

**State Geologist.** Calcite, Gaspé, Can............................ 140
**Assistant State Geologist.** Zircon in oligoclase, Mineville.......... 5
Calcite, Arnold Hill............................................. 1
**Mineralogist.** Albany. Tourmalin in quartz, Fort Ann........... 1
Tourmalin, Fort Ann............................................. 7
Orthoclase and quartz (perthite), Fort Ann...................... 1
Pyrite (nodules), Waterford...................................... 4
Pyrite (dendritic), Waterford.................................... 5
Aragonite on shale, Waterford.................................... 1
Serpentine on shale, Waterford................................... 1
Orthoclase in quartz, Crown Point Center........................ 3
Orthoclase and oligoclase, Crown Point Center.................. 1

| | |
|---|---|
| Orthoclase and epidote, Crown Point Center | 1 |
| Orthoclase phenocrysts in quartz, Crown Point Center | 3 |
| Pegmatite crystallization showing structure (large), Crown Point Center | 1 |
| Calcite, Crown Point | 29 |
| Rutile in quartz, West Pawlet, Vt | 1 |
| Quartz, West Pawlet, Vt | 30 |
| Graphite in serpentine, Columbia Graphite Mine, Crown Point | 2 |
| Graphite in feldspar, Columbia Graphite Mine, Crown Point | 5 |
| Graphite in calcite, Columbia Graphite Mine, Crown Point | 1 |
| Graphite, Columbia Graphite Mine, Crown Point | 2 |
| Serpentine, Columbia Graphite Mine, Crown Point | 1 |
| Chondrodite in serpentine, Columbia Graphite Mine, Crown Point | 1 |
| Serpentine pseudomorph after chondrodite, Columbia Graphite Mine, Crown Point | 1 |
| Calcite, Crown Point Graphite Mine, Paradox | 7 |
| —— **& Hartnagel, C. A.** Brookite in calcite, Indian Ladder | 2 |
| Epsomite, Indian Ladder | 1 |
| Calcite and quartz, Indian Ladder | 20 |
| **Total** | 465 |

ENTOMOLOGY

## Donation

*Hymenoptera*

**Woodworth, J. B.** Bembex pallidipicta Sm., cocoons, Sept. 11. Fort Edward, N. Y.

**Russell, *Miss* S. J.** Blue Point, L. I., N. Y. Cratotechus sp., adults, Aug. 20

**Burnham, S. H.** Albany, N. Y. Aulax glechomae Htg., galls on Glechoma hederacea Linn., June 20; Neuroterus batatus Finch, oak potato gall, gall on white oak, Sept. 15. Southeast of Easton, N. Y.

**Lutz, F. E.** Cold Spring Harbor, L. I., N. Y. Andricus lana Fitch, oak wool gall; A. petiolicola Bass., oak leaf stalk gall; A. seminator Harr., wool sower; A. singularis Bass., oak leaf apple; Amphibolips confluentus Harr., large oak apple; A. ilicifoliae Bass., black scrub oak gall, June 4

**Meays, Barton C.** Baldwinsville, N. Y. Kaliosysphinga ulmi Sund., elm leaf miner, larva on Camperdown or weeping elm, June 10

*Coleoptera*

**VanDuzee, E. P.** Buffalo, N. Y. Tomicus balsameus Lec., balsam bark borer, adult, June 22

**Huested, P. L.** Blauvelt, N. Y. Phymatodes amoenus Say, grapevine Phymatodes on grapevine, Mar. 19

**Posson, Chauncey.** Albany, N. Y. Hadrobregmus errans Melsh., adult on pine, Sept. 10

**Fredrick, George L.** Albany, N. Y. Dytiscus harrisii Kirby, margined water beetle, adult, Nov. 29

*Diptera*

**Stuart, C. W.** Newark, N. Y. Rhagoletis pomonella Walsh, apple maggot, larvae on apple, Sept. 5

**Eldredge, C. E.** Leon, N. Y. Scenopinus fenestralis Linn., carpet fly, larva, May 2

**Ludlow, C. S.** Washington, D. C. Anopheles maculipennis Meig., malarial mosquito, male and female; Culex microannulatus Theo., adults (male and female); C. gelidus Theo., adults (female); S. arnesii Ludlw., adults (male and female); Finlaya poicilia Theo., female; Myzomyia thorntonii Ludlw., adult (female, cotype) July 14

**Pettis, C. R.** Saranac Junction, N. Y. Anopheles punctipennis Say, Apr. 17

**Weeks, H. C.** Bayside, L. I., N. Y. Culex sollicitans Walk., salt marsh mosquito, Aug. 13; Paul Smith's, N. Y. Culiseta absobrinus Felt, larvae; Eucorethra underwoodi Undw., giant mosquito, larvae, Aug. 2

**Ashworth, J. H.** Edinburgh, Scotland. Culex pipiens Linn., house mosquito, larvae and pupae and adults, Dec. 13

**Needham, J. G.** Ithaca, N. Y. C. restuans Theo., white spotted mosquito, adult, Sept. 12. Lake Michigan.

**Grabham, M.** Jamaica, W. I. C. hassardii Gbhm., adults and larvae; Stegomyia mediovittata Coq., adults and larvae; Mochlostyrax jamaicensis Gbhm., adults and larvae; Howardina aureostriata Gbhm., adults and larvae; Corethrella appendiculata Gbhm., adults and larvae, July 2

**Balfour, Andrew.** Khartoum, Africa. Mansonia uniformis Theo., adult, Nov. 14

**Joutel, L. H.** New York city. Wyeomyia smithii Coq., pitcher plant mosquito, larvae on pitcher plant, May 7. Lakehurst, N. J.

**Haines, L.** Rhinebeck, N. Y. Contarinia violicola Coq., violet gall midge, larvae on violet, Oct. 10

*Lepidoptera*

**Dibb, F. S.** Ushers, N. Y. Satyrodes canthus Linn., adult, July 21

**Guernsey, W. J.** Albany, N. Y. Sphecodina abbotii Swainson, larvae on woodbine, July 13

**More, Alex.** Rockville Center, L. I., N. Y. Citheronia regalis Fabr., hickory horned devil, caterpillar, Sept. 13

**Russell, S. J.** Blue Point, N. Y. Apatela americana Harris, larva on maple, Aug. 20

**VanDenburg, M W.** Mt Vernon, N. Y. A. interrupta Guen., larvae, Aug. 28

**Graves, George S.** Newport, N. Y. Arsilonche albovenosa Goeze, adult, June 10

**Gabriel, M.** Mileses, N. Y. Hadena arctica Boisd., cutworm, adult, July 28

**Erwin, J. M.** New Salem, N. Y. Peridroma margaritosa Haw., variegated cutworm, larvae; light army worm, Heliophila unipuncta Haw., July 25

**Lutz, F. E.** Cold Spring Harbor, N. Y. Paragrotis messoria Harris, dark-sided cutworm, larvae, May 30; Papaipema nitela Guen., larvae, June 26

**Martin, S. C.** Schenectady, N. Y. Paragrotis messoria Harris, dark-sided cutworm, larvae, June 1

**Fitch, F. A.** Randolph, N.Y. Mamestra adjuncta Boisd., adult, May 21

**Stevens, C. N.** South Gilboa, N. Y. Catocala relicta Walk., moth, Sept. 20

**Bartlett, Alice E.** Delhi, N. Y. C. grotiana Bailey, Aug. 13

**Holt, Emmett.** New York city. Paleacrita vernata Pack., spring canker worm, larva on apple, June 4

**Theobald, F. V.** Egypt. Earias insulana Boisd., eggs, larvae, adult on cotton, Dec. 23

**Von Schrenk, Hermann.** ?Oiketicus abbotii Grote, southern bagworm on cyprus, Jan. 8. New Orleans, La.

**Mekeel Bros.** Yorktown Heights, N. Y. Sibine stimulea Clem., saddleback caterpillar, larva, Aug. 16

**Beebe, F. N.** Walton, N. Y. Euclea delphinii Boisd., slug caterpillar, larvae, Sept. 4

**Weston, Helen.** West New Brighton, S. I., N. Y. Zeuzera pyrina leopard moth, larvae in maple, Sept. 7

**Wilson, F. P.** Schenectady, N. Y. Sesia pictipes Gr. & Rob., larvae on plum, June 15

**Joutel, L. H.** New York city. ?Thiodia, species on oak, May 24

**Stevens, Robert L.** Westbury, N. Y. Eulia politana Haw., pine tube builder on white pine needles, Jan. 10

**Covert, H. W.** Waterford, N. Y. Coptodisca splendoriferella Clem., resplendent shield bearer, work, Sept. 30

*Neuroptera*

**Blakeslee, G. G.** Rensselaer, N. Y. Corydalis cornuta Linn., devil fly or horned Corydalis, adult, July 14

**Connally, E. F.** Troy, N. Y. Chauliodes pectinicornis Linn., comb horned fish fly, adult, July 28

*Hemiptera*

**Lutz, F. E.** Cold Spring Harbor, N. Y. Tibicen septendecim Linn., periodical cicada, adult, May 28; Phylloxera caryaeglobuli Walsh, June 4

**Smith, H. D.** Center Moriches, N. Y. Tibicen septendecim Linn., periodical cicada, adult, June 12

**Barry, Thomas.** Albany, N. Y. Belostoma americana Leidy, Apr. 19

**Linsley, Julius G.** Oswego, N. Y. Schizoneura americana Riley, young and adults on elm, June 22

**Andrews, James M.** Schenectady, N. Y. Chermaphis abietis Linn., spruce gall aphid, galls, June 20

**Cockerell, T. D. A.** Boulder, Col. Alcyrodes betheli Ckll. M. S., on Berberis, Sept. 27. Ouray, Col.; Chrysomphalus rossi Mask., Sept. 27. Lucban, P. I.; Coccus diversipes Ckll., on fern, Sept. 27. Lucena, P. I.

**Pettis, C. R.** Saranac Junction, N. Y. Chermes pinicorticis Fitch, pine bark aphid, hatching young on pine, May 29

**Anderson, J. R.** Victoria, B. C. Parlatoria proteus Curt., on Japanese orange, Jan. 4; Pseudaonidia duplex Ckll., on orange from Japan, Dec. 18; Aspidiotus rapax Comst., greedy scale on California lemon, Jan. 4; Hemichionaspis minor? Mask., on orange from Japan, Dec. 18

**Moore, Reuben.** Chatham, N. Y. A. ancylus Putn., adult on apple, Jan. 15

**Bostwick, Fred.** Poughkeepsie, N. Y. Aulacaspis rosae Bouché, rose scale on rose, Apr. 3

**Wheeler, M. S.** Berlin, Mass. Aulacaspis rosae Bouché, rose scale on blackberry, Aug. 13

**Dunbar, John.** Rochester, N. Y. Diaspis carueli Targ., juniper scale, adult on Pinus aristata and Juniperinus virginiana, Apr. 16

**Stevens, Robert L.** Westbury, L. I., N. Y. Chionaspis pinifoliae Fitch, scurfy pine scale on Scotch pine needles, Jan. 10

**Fellows, *Miss* F. E.** Norwich, Ct. Eulecanium tulipiferae Cook, tulip tree scale, young and adults on tulip, Sept. 17

**Mead, Herbert.** Lake Waccabuc, N. Y. Eulecanium tulipiferae Cook, tulip tree scale, young and adults on tulip, July 27

**Niles, T. F.** Chatham, N. Y. E. nigrofasciatum Perg., terrapin scale on maple, Sept. 13

**Van Fredenberg, H. A.** Port Jervis, N. Y. Pseudophilippia quaintancii Ckll., woolly pine scale, adults on pitch pine, Nov. 20; Phenacoccus acericola King, false maple scale, adults and young on maple, July 24

**Pierce, Charles M.** Adams, N. Y. Pulvinaria innumerabilis Rathv., cottony maple scale, adults and young on Virginia creeper, July 3

**Studwell, Edward F.** Port Chester, N. Y. Phenacoccus acericola King, false maple scale, larvae on maple, Sept. 18

*Orthoptera*

**Morehouse, F. A.** Ripley, N. Y. Oecanthus niveus DeG., white flower cricket, eggs on grape, Apr. 30

**Williams, William.** Milton, N. Y. Gryllotalpa borealis Burm., mole cricket, adult, Oct. 8

**Richard, George L.** Diapheromera femorata Say, walking stick, adult, Oct. 12, Altamont, N. Y.

**Palmatier, Tilden.** Athens, N. Y. Periplaneta australasiae Fabr., Australian cockroach, nymph, June 7

*Miscellaneous*

**Alexander, Charles.** Gloversville, N. Y. Some of the more desirable forms donated by him follow: Bembidium ustulatum Linn., Agabus seriatus Say, Choleva terminans Lec., Philonthus umbrinus Grav., Lathrobium punctulatum Lec., Tachinus memnonius Grav., T. luridus Er., Dermestes frischii Kug., Anthaxia aeneogaster Lap., Stephanocleonus plumbeus Lec., Atymna castanea Fitch, Carabus serratus Say, Necrophorus americanus Oliv., Alaus myops Fabr., Calloides nobilis Say, Tylonotus bimaculatus Hald., Neuronia pardalis Walk.

**Exchange**

**E. S. Tucker.** Lawrence, Kan. Ophion idoneum Vier., Bracon xanthostigma Cr., Melanobracon ulmicola Vier., Agathis vulgaris Cr., Calyptus rotundiceps Cr., Aphaereta dolosa Vier., Nemigonia limosa Wheel.,

Lasius niger Linn. var. americanus Emery, Pelecinus polyturator Dru., Pompilus relatinus Fox, Isodontia azteca Sauss., Tachytes spatulatus Fox, Tachytes obscurus Cr., Sphecius speciosus Dru., Euspongus bipunctatus Say, Mellinus rufinodus Cr., Mimesa punctata Fox, Stigmus inordinatus Fox, Epeolus occidentalis Cr., Clisodon terminalis Cr.

Staphylinus maculosus Grav., Romaleum atomarium Dru., Myochrous denticollis Say, Tomicus grandicollis Eich.

Catocala junetina Walk var. aspasia Strk.

Ceratopogon squamipes Coq., Scatopse notata Loew., Allognosta fuscitarsis Say, Tabanus sulcifrons Macq., Xylomyia pallipes Loew., Deromyia ternata Loew., Erax stamineus Will., Psilopodinus sipho Say, Dolichopus bifractus Loew., Dolichopus cuprinus Wied., D. longipennis Loew., Empis clausa Coq., Rhamphomyia nasoni Coq., Eupeodes volucris O. S., Allograpta obliqua Say, Oncomyia loraria

Loew., Myiophasia aenea Wied., Siphoplagia anomala Town., Blepharipeza leucophrys Wied., Paradidyma singularis Town., Myiocera cremides Walk., Sarcophaga helicis Town., Morellia micans Macq., Limnophora narona Walk., Phorbia cinerella Fall., Coenosia lata Walk., Schoenomyza dorsalis Loew., Scatophaga furcata Say, Borborus equinus Fall, Lonchaea polita Say, Pachycerina dolorosa Will., Pseudotephritis cribrum Loew., Straussia longipennis Wied., Urellia actinobola Loew., Calobata antennipes Say, Nemopoda minuta Wied., Elachiptera costata Loew., Oscinis coxendix Fitch, Drosophila graminum Fall., Phormia regina Meig.

Corimelaena nitiduloides Wolff., Melanaethus uhleri Sign., Oebalus pugnax Fabr., Menecles insertus Say, Catorhintha mendica Stal., Anasa armigera Say, Hadrodema pulverulenta Uhl., Tygus distantii St. F., Nabis rufusculus Reut., Sinea raptoria Stal., Agallia 4-punctata Prov., Deltocephalus melsheimeri Fabr., Dicraneura abnormis Walsh., Oncometopia costalis Fabr., Orthotylus flavosparsus Dhlb.

Hemerobius stigmaterus Fitch, Chrysopa nigricornis Burm., C. florabunda Fitch, Hydropsyche kansensis Bks., H. phalerata Hag., H. scalaris Hag.

Stylopyga orientalis Linn.

Sympetrum corruptum Hag.

*Chrysididae*

**Mocsary, A.** Budapest, Hungary. Cleptes pallipes Lep., Notozus panzeri Fabr., Elampus auratus Linn., E. auratus var. virescens Mocs., E. bogdanovii Rad., E. aeneus Fabr., Holopyga amoenula Dhlb., H. amoenula var. punctatissima Dhlb., H. ahenea Dhlb., H. curvata Forst., H. gloriosa Fabr., H. chrysonota Forst., H. rosea Rossi, Hedychrum gerstaeckeri Cheve., H. nobile Scop., H. rutilans Dhlb., Stilbum cyanurum Forst. var. amethystinum F., Chryrogona pumila Rl., Spintharis vagans Rad., Chrysis austriaca Fabr., C. cuprea Rossi, C. dichroa Dhlb., C. elegans Lep., C. versicolor Spin., C. saussurei Cheve., C. succincta Linn., C. leachii Shuck., C. cyanea Linn., C. nitidula Fabr., C. viridula Linn., C. ignita Linn., C. splendidula Rossi, C. rutilans Oliv., C. scutellaris F., C. scutellaris var. ariedne Mocs., C. inequalis Dhlb., C. comparata Lep., C. chloris Mocs., C. lyncea F. var. papuana Mocs., C. sexdentata Christ., C. (Euchroeus) purpuratus F., Tarnopes grandior Tall. (carnea Rossi)

*Diptera*

**Kertesz,** *Dr* **C.** Budapest, Hungary. Tabanus tergestinus Egg., T. sudeticus Zell., T. spodopterus Meig., T. rusticus Fabr., T. quatuornotatus Meig., T. graecus F.?, T. fulvus Meig., T. tropicus Linn., T. bromius Linn., T. bovinus Linn., T. autumnalus Linn., T. auripilus Meig. var. aterrimus. T. africus Meig., Culex dorsalis Meig., C. vexans Meig., C. cantans Meig., C. ornatus Meig., C. pulcritarsis Rond., C. modestus Ficl., C. pipiens L., C. annulipes Meig., Aedes cinereus Meig., Anopheles maculipennis Meig.

*Culicidae*

**Crum, Ebb.** Lawrence, Kan. Anopheles maculipennis Meig., Psorophora ciliata? Abr. young larva, Ecculex sylvestris Theo., Culex restuans Theo., C. territans Walk., C. ?tarsalis Coq., C. salinarius? Coq., Grabhamia discolor Coq., G. jamaicensis Theo., Culicada canadensis Theo.

*Tachinidae*

**Bezzi, Mario.** Torino, Italy. Meigenia bisignata Meig., Dexodes machaeropsis R. D., Hemimasicera ferruginea Meig., Parexorista polychaeta, Blepharida vulgaris Fall. var. stridens Bd., Perichaeta unicolor Fall., Mintho praeceps Scop., Melanota volvulus Fabr., Anthracomyia melanoptera Fall., Macquartia chalconota Meig., M. dispar Fall., Thelaira leucozona Panz., Zophomyia temula Scop., Myobia inanis Fall., Ocyptera bicolor Oliv., O. brassicaria Fabr., Bonellia picta Meig., Ernestia consobrina Meig., Echinomyia grossa Linn., Eudoromyia magnicornis Zett., Plagia ruralis Fall., Phasia crassipennis Fabr., Brachycoma devia Fall., Rhinophora atramentaria Meig., Metopia leucocephala Ross., Miltogramma oestracea Fall., Dexiosoma caninum Fabr.

**Purchase**

**Snow,** *Prof.* **F. H.** Lawrence, Kan. Psychoda alternata Say, Ceratopogon argentatus Lw., C. pergandei Coq., C. specularis Coq., Anopheles pseudopunctipennis Theo., Neoglaphyroptera bivittata Say, Cecidomyia radiatae Snow, Chrysops aestuans V. d. W., C. celer O. S., C. flavidus Wied., C. fugax O. S., C. indus O. S., C. striatus O. S., C. univittatus Macq., Tabanus costalis Wied., T. lasiophthalmus Macq., T. melanocerus Wied., T. molestus Say, T. nivosus O. S., T. pumilus Macq., T. stygius Say, T. trimaculatus P. B., T. venustus O. S., Eumetopia rufipes Macq., Stenopa vulnerata Lw., Plagiotoma obliqua Say, Carphotricha culta Wied., Neaspilota alba Lw., Tephritis clathrata Lw., Urellia solaris Lw.

Anelastes drurii Kir., Ischiodontus soleatus Say, Glyphonyx recticollis Say, Corymbites hieroglyphicus Say, Pyrophorus physoderus Germ., Euthysanius lautus Lec., Plastocerus schaumii Lec., Hylotrupes bajulus Linn., Sphaenothecus suturalis Lec., Coenopoenus palmeri Lec., Leptostylus aculiferus Say, Mecas inornata Say, Macrorhoptus estriatus Lec., Conotrachelus similis Boh., C. leucophaeatus Fah., Pityophthorus nitidulus Mann., Dendroctonus similis Lec., Hylastes nigrinus Mann., Lasioderma testaceum Duft., Hemiptychus gravis Lec., Sinoxylon simplex Horn., S. sericans Lec., S. sextuberculatum Lec., Amphicerus fortis Lec., A. punctipennis Lec., Polycaon obliquus Lec., Lyctus californicus Cr.

Total ........................................ 357

## ZOOLOGY

### Donation

#### *Mammals*

**Calhoun, Fred.** Albany. Big brown bat, Vespertilio fuscus Beauvois ........ 1

**Dawley, F. E.** Fayetteville. Woodchuck (melanistic), Arctomys monax (Linn.) ........ 1

**Richard, W. C.** West Waterford. Rock pika, Ochotona saxatilis Bangs, Wyoming ........ 1

**Vander Veer, William.** Cobleskill. Wildcat, Lynx ruffus (Gueldenstaedt) ........ 1

#### *Birds*

Those marked † are sex or plumage specimens new to the collection.

**Alexander, C. P.** Gloversville. Nashville warbler, Helminthophila rubricapilla (Wilson), eggs ........ 2

Migrant shrike, Lanius ludovicianus migrans Palmer, eggs ........ 2

**Hall, C. K.** Albany. Hairy woodpecker, Dryobates villosus (Linn.) ........ 1

**Higgins, Charles D.** Spencertown. Many-storied nest of robin, Merula migratoria (Linn.) ........ 1

**Short, E. H.** Coldwater. †Pied-billed grebe, Podilymbus podiceps (Linn.) ........ 2

#### *Reptiles and batrachians*

**Alexander, Charles P.** Gloversville. Milk snake, Osceola doliata triangula (Boie) ........ 1

Spotted salamander, Amblystoma punctatum (Linn.) ........ 1

**Card, Leroy Cox.** Albany. Chameleon, Anolis principalis (Linn.) (Captured in American Express office, Albany) ........ 1

**Olcott, Douglas W.** East Greenbush. Ring-necked snake, Diadophis punctatus (Linn.) .... 1
**Spencer, J. I.** Albany. Young garter snakes, Eutaenia sirtalis (Linn.) (Taken from two females) .... 145
**State Barge Canal office,** Albany. Blowing adder, Heterodon platyrhinus Latreille .... 1

*Invertebrates*

**Alexander, Charles P.** Gloversville. Spiders and phalangids .... 71
Myriapods .... 3
Wood louse, Porcellio rathkei Brandt .... 1
**Edmonds, W. D.** Alder Creek. Polyzoan, Pectinatella magnifica Leidy .... 1
**Hibbard,** *Dr* **D. V. M.** Olean. Cave shrimp, Crangonyx tenuis Smith (From a driven well) .... 9
**Irwin,** *Miss.* Clinton Heights. Spider, Epeira trifolium Hentz .... 1
**Lutz, F. E.** Cold Spring Harbor. Myriapod, Iulus .... 1
**Miller, W.** Nassau, Bahama Is. Spiders, Latrodectus mactans (Fabricius) .... 9
**Ortmann, A. E.** Princeton, N. J. Crayfish from Pennsylvania.
Cambarus diogenes Girard .... 2
Cambarus limosus (Rafinesque) .... 2
Cambarus monongalensis Ortmann .... 3
Cambarus obscurus Hagen .... 2
Cambarus bartoni robustus Faxon .... 1
**Polk, George W.** Poughkeepsie. Spider .... 1
**Weed, C. M.** Sinclairville. Hairworm, Paragordius varius Leidy .... 1
——— Albany. Huntsman spider, Heteropoda venatoria (Linn.) (Probably brought north in bananas) .... 1

## Purchase

*Mammals*

**Williams, George.** Rexford Flats. Wildcat, Lynx ruffus (Gueldenstaedt) .... 1

*Birds*

Birds marked * are species new to the collection.
Those marked † are sex or plumage specimens new to the collection.

**Dooley, T. J.** Albany. American osprey, Pandion haliaetus carolinensis (Gmel.) .... 2
**Guelf, George F.** Brockport. Caspian tern, Sterna caspia Pallas .... 1
Wilson's petrel, Oceanites oceanicus (Kuhl) .... 1
†Red-breasted merganser, Merganser serrator (Linn.) .... 1
White-winged scoter, Oidemia deglandi Bonaparte .... 1
†Surf scoter, Oidemia perspicillata (Linn.) .... 1

†Little blue heron, Ardea caerulea Linn. . . . . . . . . . . . . . . . . 1
†Black-bellied plover, Squatarola squatarola (Linn.) . . 1
*Belted piping plover, Aegialitis meloda circumcincta Ridgway . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
†Broad-winged hawk, Buteo latissimus (Wilson) . . . . . . . 1
†American rough-legged hawk, Archibuteo lagopus sanctijohannis (Gmel.) . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
Green-crested flycatcher, Empidonax virescens (Vieillot). . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
*Alder flycatcher, Empidonax trailli alnorum Brewster . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
†Cerulean warbler, Dendroica rara Wilson. . . . . . . . . . . . . 1
Mourning warbler, Geothlypis philadelphia (Wilson) 1
†Varied thrush, Hesperocichla naevia (Gmel.) . . . . . . . . 1

**Parker, Foster**. Cayuga. *American white pelican, Pelecanus erythrorhynchos Gmel. . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
Baldpates, Mareca americana (Gmel.) . . . . . . . . . . . . . . . . 2
†Least bittern, Ardetta exilis (Gmel.) . . . . . . . . . . . . . . . . . 1
*Hybrids between game bantam and English pheasant . . . . . . . . . 2

**Ward's Natural Science Establishment.** Rochester. *Black-throated loon, Gavia arctica (Linn.) . . . . . . . . . . . . . . . . . . . . . . . 1
†Dovekie, Alle alle (Linn.) . . . . . . . . . . . . . . . . . . . . . . . . . . 1
*Pomarine jaeger, Stercorarius pomarinus (Temm.) . . 1
*Herring gull, Larus argentatus Brünn . . . . . . . . . . . . . . . . 1
*Fulmar, Fulmarus glacialis (Linn.) . . . . . . . . . . . . . . . . . . . 1
*Cory's shearwater, Puffinus borealis Cory . . . . . . . . . . . 1
American white pelican, Pelecanus erythrohynchos Gmel. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
†Lesser scaup duck, Aythya affinis (Eyt.) . . . . . . . . . . . . . . . 1
†Harlequin duck, Histrionicus histrionicus (Linn.) . . 1
†American eider, Somateria dresseri Sharpe . . . . . . . . . . . 1
Least bittern, Ardetta exilis (Gmel.) . . . . . . . . . . . . . . . . . . 1
†Sandhill crane, Grus mexicana (Müller) . . . . . . . . . . . . . . . . 1
*Long-billed dowitcher, Macrorhamphus scolopaceus (Say). . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
*Ruff, Pavoncella pugnax (Linn.) . . . . . . . . . . . . . . . . . . . . . 1
*Hudsonian curlew, Numenius hudsonicus Lath . . . . . . . . . 1
†Black-bellied plover, Squatarola squatarola (Linn.) . . 1
†Broad-winged hawk, Buteo latissimus (Wilson) . . . . . . . . 2
*Red-naped sapsucker, Sphyrapicus varius nuchalis Baird . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2
†Red-bellied woodpecker, Melanerpes carolinus (Linn.) 1
*Scissor-tailed flycatcher, Milvulus forficatus (Gmel.). 1
Bullock's oriole, Icterus bullocki (Swainson) . . . . . . . . . . 1
†Grasshopper sparrow, Ammodramus savannarum passerinus (Wilson) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
*Leconte's sparrow, Ammodramus lecontei (Audubon) 1
*Nelson's sparrow, Ammodramus caudacutus nelsoni (Allen) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1

*Acadian sharp-tailed sparrow, Ammodramus caudacutus subvirgatus (Dwight)............................ 1
†Cardinal, Cardinalis cardinalis (Linn.).............. 1
Painted bunting, Cyanospiza ciris (Linn.).............. 1
*Plumbeous vireo, Vireo solitarius plumbeus (Coues) 1
†Prairie warbler, Dendroica discolor (Vieillot).......... 1
*Grinnell's waterthrush, Seiurus noveboracensis notabilis (Ridgway)...................................... 1
*Connecticut warbler, Goethlypis argilis (Wilson)..... 1
†Mourning warbler, Geothlypis philadelphia (Wilson) 1
*Carolina chickadee, Parus carolinensis Audubon...... 1
†Bluegray gnatcatcher, Polioptila caerulea (Linn.).... 1

### *Invertebrates*

**Ward's Natural Science Establishment.** Rochester. Peripatus, Peripatus novaezealandiae................................ 1

## Collection

### *Mammals*

Deer, Odocoileus americanus (Erxleben)........... 1
Woodchuck, Arctomys monax (Linn.).................. 1
Deer mouse, Peromyscus leucopus noveboracensis (Fischer)........................................... 1
Naked-tailed mole, Scalopus aquaticus (Linn.)........ 1

### *Birds*

Sora, Porzana carolina (Linn.) (With material for group) 2
†American coot, Fulica americana Gmelin.............. 1
Ruffed grouse, Bonasa umbellus (Linn.).............. 3
†American sparrow hawk, Falco sparverius Linn........ 2
Yellow-billed cuckoo, Coccyzus americanus (Linn.) eggs................................................... 3
Crested flycatcher, Myiarchus crinitus (Linn.)........ 1
†Canada jay, Perisoreus canadensis (Linn.)........... 1
Purple finch, Carpodacus purpureus (Gmel.)......... 1
Savanna sparrow, Ammodramus sandwichensis savanna (Wilson)......................................... 1
†Henslow's sparrow (?), Ammodramus henslowi (Audubon)................................................ 1
Slate-colored junco, Junco hyemalis (Linn.) (With material for group)........................................... 2
†Towhee, Pipilo erythrophthalmus (Linn.).......... 1
Indigo bunting, Cyanospiza cyanea (Linn.)........... 1
Red-eyed vireo, Vireo olivaceus (Linn.)................ 1
Yellow-throated vireo, Vireo flavifrons Vieillot........ 1
Blue-headed vireo, Vireo solitarius (Wilson).......... 1

| | |
|---|---|
| Nashville warbler, Helminthophila rubricapilla (Wilson) | 1 |
| Yellow warbler, Dendroica aestiva (Gmel.) | 1 |
| Cerulean warbler, Dendroica rara Wilson | 1 |
| Chestnut-sided warbler, Dendroica pennsylvanica (Linn.) | 1 |
| †Blackpoll warbler, Dendroica striata (Forst.) | 1 |
| Yellow-breasted chat, Icteria virens (Linn.) (With material for group) | 2 |
| House wren, Troglodytes aëdon Vieillot | 1 |
| †Winter wren, Anorthura hiemalis (Vieillot) | 1 |
| Long-billed marsh-wren, Cistothorus palustris (Wilson) eggs | 2 |
| Red-breasted nuthatch, Sitta canadensis Linn | 1 |

*Reptiles*

| | |
|---|---|
| Milk snake, Osceola doliata triangula (Boie) by members of the entomological staff | 1 |

*Invertebrates*

| | |
|---|---|
| About 250 specimens of invertebrates, almost wholly spiders (Araneida) have been collected, one third of these by members of the entomological staff | 250 |
| **Total** | 621 |

### ARCHEOLOGY

## Donation

**Conner, Arthur.** Walton, N. Y. 1 single winged bannerstone from Shinhopple, Hancock township, Delaware co. Found on bank of Delaware river

**Persons, G. H.** Catskill. Two humeri with perforations of the olecanon cavity from skeleton of an Indian female found on the Du Bois farm, Catskill

**Richard, George L.** Waterford. Chipped implements of red Westchester slate from Peobles island

**Burmaster, Everett.** 1 small celt found on Newton farm, Irving

**Mattern, J. E.** West Rush. 86 fragments of pipe stems from Seneca village of Totiacton (Rochester junction)

**Beardsley, Egbert.** Catskill. 2 hammer stones and one net sinker from Catskill

## Purchase

DURING MARCH AND APRIL 1906

1 false face, Ga-goh-sah

1 false face, Ga-goh-sah, Seneca tribe. Used in marching ceremonial

1 ceremonial mask, Ga-goh-sah, Seneca tribe, Tonawanda bank. Pur-

chased March 17, 1906. This mask is supposed to be imbued with the spirits of birds. It was an important mask of the Tonawanda Lodge of the False Face Company

1 husk face. Doorkeeper's mask of the Husk Face Company. Object illustrating the uses of the *corn* plant to the Iroquois.

1 lover's flute, Ye-o-da-wus-toh. Purchased April 13, 1906, on the Tonawanda Reservation. Seneca tribe. Flute made 1804 by Chief Senoiucieh (A. Charl)

1 flute, Seneca tribe, Tonawanda band. Purchased March 17, 1906. Flutes of this kind were used by lovers to serenade their sweethearts.

1 silver hatband, Di-ye-sta-hus-tah or Di-ye-ga-hi-hus-toh; Seneca. Worn by Chief *Dwa-ni-o-no,* Tall Peter. The last treasured crown of the Tonawanda sachems. Purchased April 15, 1906

10 Seneca silver brooches, purchased on the Tonawanda Reservation, April 13, 1906. Brought from the Genesee reserve. A rare pattern

4 miscellaneous brooches and a portion of a dress ornament

13 silver brooches as follows, known as Chief Sundown's brooches:
 7 council brooches
 2 Medicine Lodge brooches (owl)
 1 star and circle — sun brooch
 1 marriage brooch
 2 large Wolf council fire brooches

20 double bar council brooches, iniuska De-io-a-wan; records of Seneca councils. Purchased April 13, 1906 on Tonawanda Reservation

4 single bar brooches, Ska-wen iniuska. Seneca tribe

3 silver brooches, iniuska. Purchased on Tonawanda Seneca Reservation, March 17, 1906. The two large brooches are said to have been made before the Revolutionary War from English coins

3 pairs of silver earrings, Tonawanda, March 17, 1906

1 covered provision basket, Ga-us-ha-wa-da-we-shas. Unusually fine weave. Purchased on the Tonawanda Reservation, April 13, 1906

1 bark basket

1 bread bowl (wooden) Ga-o-wa a-kwa. Seneca tribe, Tonawanda band. Purchased March 16, 1906. Used for mixing hulled corn meal for boiled bread. Made by Black Squirrel, 1814

1 child's spoon, Ah-to-gwus-ha. Seneca tribe

2 wooden spoons, Ah-to-gwus-ha. Tonawanda tribe. Purchased March 16, 1906

1 Weasel skin charm. This skin contains certain charm powders much prized by the Iroquois for their reputed luck-giving powers. To awaken the spirit of the charm one must strike himself with the skin, when it will be susceptible to commands. Without special invocation, it is considered a potent charm against diseases of the chest.

1 water drum, Ga-noh-jah. Seneca tribe, Tonawanda band. Purchased March 15, 1906. This was the lodge drum of the Buffalo Society.

2 Heron feather fans, used in the ceremonies of the Seneca Order of the Eagles, a native Indian fraternity of great antiquity. These fans belonged to Gaioyade, the chanter of the Eagles, and a member

of the Heron clan. Heron feather fans must always have six feathers, but a fan of Eagle feathers may contain four. A picture accompanying these specimens illustrates the use of the fans and rattles in the lodge ceremonies of the Eagles. Purchased at Newtown Reservation, near Lawton Station, N. Y., March 30, 1906

2 gourd rattles used with Heron feather fans in the Seneca Eagle dance. The rattles are held in the right hand and the fans in the left. These rattles were the property of the singer of the Order of the Eagles, a Seneca secret fraternity of great antiquity.

1 great feather dance rattle (turtle shell). For many years this was the Long House rattle of the Senecas and was always used in the celebration of their sacred dance. It is unlike the false face rattles in that the sternum is or was stained red in token of its sacred employment. Purchased March 27, 1906

1 rattle of the Eagle Society. Gaa-né-gwe-e Gus-nohgus-to-we-se. Purchased on the Cattaraugus Reservation, March 19, 1906. This rattle must not be confused with the bark rattles of the False Face Company.

4 horn rattles, Gus-to-wūs-ha O-nonk-ga. Seneca tribe, Tonawanda band. Purchased March 16, 1906. These rattles have been used for many years by the Eagle Medicine Society of the Senecas in their secret ceremonies.

1 tobacco pole, such as is now used instead of a dog pole in the midwinter ceremonies of the Senecas. Purchased April 1906

8 moon dance buttons, Gus-keh-i-seh-doh. Deer bone button game. Purchased on Tonawanda Seneca Reservation, March 16, 1906. These buttons were used in the moon dance ceremony for many years and are very old. In the game, they are thrown from the hand, the counts being as follows: all of one color, 20; one of a color, 4; two of a color, 2. Opposite clans contest in the moon dance. Beans are used for counters and the party winning all the beans will enjoy the favor of the moon for the ensuing year.

8 buttons, Gus-keh-i-seh-doh. Deer bone button game. Purchased on Tonawanda Reservation, March 17, 1906. These game "buttons" were used by the Tonawanda Senecas in the moon dance ceremony. The moon is said to love the game because the buttons are patterned after her face.

6 peach stone dice, used at Tonawanda Long House for 40 years play the sacred bowl game at the annual midwinter festival. Purchased March 16, 1906

1 baby board, Ga-o-yas-ha. Seneca tribe, Tonawanda band. Purchased March 15, 1906. Ga-ni-o-dai-euh, a tribal successor to Handsome Lake, a Seneca prophet, was strapped to this board when an infant.

1 baby board, Ga-o-yas-ha. Seneca tribe, Tonawanda band. Purchased on Tonawanda Reservation, March 16, 1906. This board was used by Stephen Skeye, Gah-don-dyieh, Flying Feathers. Baby boards are good examples of Indian carved woodwork.

1 burden strap, Gus-ha-a. Purchased April 13, 1906 on Tonawanda Reservation. This strap is made of elm bark and was found in use.

1 burden strap, Gus-ha-ah. Seneca tribe, Tonawanda band. Purchased March 16, 1906. Woven from native material and said to have been in use before the War of 1812. Found in use
1 Seneca woman's skirt, Ga-ka-a. Purchased April 13, 1906 on Tonawanda Reservation. Found in use
1 beaded binding blanket of broadcloth for baby board, Gus-swa-hus-ha. Purchased on Tonawanda Reservation March 17, 1906. This blanket was said to be the last of the kind to be found among the New York Senecas. (2 pieces, 1 red and 1 blue)
1 pair of moccasins made in 1878 by a Seneca woman after the old Mohawk style. The moose hair embroidered pattern on the toes is now widely copied on moccasins sold for commercial purposes. Purchased March 27, 1906
1 pair of baby moccasins, Ga-zun-i-ah Ata-kwa. Seneca tribe, Tonawanda band. Purchased on Tonawanda Reservation, March 16, 1906. The hole in the sole of one moccasin is purposely made that the baby may tell the spirits that seek to lure it to the spirit world that it is not properly shod for the long journey of death, since strong, new moccasins must be on the feet of those who journey skyward.
1 pair of ceremonial leggings, Gais-hăl. Formerly owned by the daughter of Black Squirrel. Purchased on the Tonawanda Reservation, March 16, 1906
1 pair of women's leggings, Gais-hăh. Seneca tribe. Tonawanda Reservation. Purchased March 16, 1906
2 short snow snakes, Ni-wa-ah ga-was-sa. This short form of the snow snake is said to have been devised by the Tonawanda band of Senecas, who discovered that they could throw them with greater ease and at a greater distance than the long " sticks " in general use. Purchased March 16, 1906, on Tonawanda Reservation

PURCHASED JUNE 1906

1 Gus-to-weh or Seneca ceremonial hat, used by Chief Kettle for 16 years in the Great Feather ceremony
1 bark cooking bowl purchased from Chief Ga-niu-dai-euh
1 husk basket used in the Seneca Dark Dance ceremony
1 husk salt bottle, made by Ho-non-di-ont O-dan-koat

**Mattern, Joseph E.** West Rush, Monroe co. N. Y.

Celts from Monroe county

6 celts, beveled on one side and flat on other side, West Rush
1 celt, large, beveled on one side and flat on other side, West Rush
1 celt, round top, flat bottom
7 equilateral celts
1 round celt
1 double edged celt, small
1 long celt from Honeoye creek
1 equilateral celt
2 rude celts
1 flat bellied celt
4 gouges

Celts from Livingston county

3 short, broad celts from Caledonia
2 flat bellied celts
3 small flat bellied celts
1 celt, very small
1 polished flint celt, small
1 broad celt from Fort Hill
3 gouges
1 broken celt from Chittenango county
1 large celt from Ontario county
1 black celt, rounded type
3 matetes from Fort Richmond
3 pitted hammer stones
5 type 1 hammer stones
5 type 2 hammer stones
3 pitted, type 3 hammer stones
2 type 3-1 hammer stones
1 pestle, Livingston county
1 pestle
4 pestles from West Rush, Monroe co.
1 pestle from Chenango county
1 perforated pendant
4 net sinkers
1 box containing specimens from the Woodruff farm, West Rush: 1 calcedony flake, 1 antler punch, 1 string of 20 tubular bone beads, 1 bone needle, fine perfect specimen, 4 imperfect bone needles, 14 bone awls
1 bone ball
5 brass points on card
3 brass cones on card
15 bone awls from Richmond Mills
9 fine large awls from Old Fort, Richmond Mills
1 fine awl from Woodruff farm, West Rush
1 bone harpoon point from West Rush
1 string of varicolored glass beads, (216)
1 string holding glass, shell and wampum beads
200 glass and wampum beads from Lima
1 string of round Venetian beads from Totiacton
1 string 4 feet long holding blue, white and red beads
1 string 2 feet long holding wampum beads from Dibble farm, Lima
2 perforated bear teeth
5 perforated wolf teeth
2 perforated elk teeth
2 phalanx cups
2 water snail shells
1 iron saw from Totiacton
1 iron spatula from Totiacton
2 bone reamers
1 section of bone reamer
1 fine specimen of antler awl

1 bone knife
1 antler point
1 bone awl
3 small antler chisels
1 string of tubular bone beads as follows: 18 tube beads of various sizes, 3 perforated phalanges, 5 femur perforated balls
1 bone tube from Woodruff farm
1 bone tube from Old Fort, Log Pond
12 conical legging rattlers
2 perforated lead balls
2 conical iron legging rattlers
2 spirally wound coils
3 catlanite beads
1 small Jesuit ring with picture representing the adoration of the Christ child by the wise men
10 large discoidal beads
48 small discoidal shell beads
23 tubular *busycon* cone beads
1 pendant
1 double diametrically drilled dot-decorated pendant
1 triangular pendant
2 fine specimens of bar amulets from West Rush
1 semilunar knife, exceptionally fine specimen from West Rush
1 gorget with single perforation from Hopewell, Ontario co.
1 gorget with two perforations from Gibbard farm, West Rush
1 gorget with a single perforation from West Rush
1 gorget double drilled and inscribed from York, Livingston co.
1 double perforated gorget from New York State farm, Rush
1 fragment of a gorget, Rush
1 half section banner stone, Rush
2 half sections banner stone, West Rush
1 portion broken shale knife
1 perforated tablet, West Rush
183 shouldered flints from Livingston county
8 blank blades from Livingston county
120 shouldered points from Monroe county
60 shouldered points from West Rush
2 triangular points from Rush
43 triangular points from West Rush, N. Y.
27 flints, various, West Rush, N. Y.
56 unusual points, Genesee valley
12 bunts, Genesee valley
17 long shouldered flints from Monroe county
13 broad shouldered flint points from Monroe county
6 spears from Afton
4 spears from Livingston county
3 knives, Livingston county
1 knife, Erie county, from site of Red Jacket's farm
1 iron knife blade
17 scrapers from Monroe county

60 flints from Livingston county
60 scrapers from Livingston county
12 bunts from Monroe county
9 spears from Monroe county
30 notched points from Monroe county
22 triangular flints from Monroe county
37 various flints from Piffard
10 blank blades from Piffard
9 points from West Rush
19 broad shouldered points from Rush
16 broad points from Rush
8 triangular points from Richmond Mills
4 bunts from Richmond Mills
73 shouldered points from Afton
15 variously formed points from Genesee Valley Junction
3 perforators
75 shouldered arrow points from Afton
17 triangular points from Genesee valley
17 scrapers from Livingston county
15 bunts from Monroe county
4 blanks from Monroe county
20 shouldered points from Monroe and Livingston counties
60 spears in box
22 large spears in box
325 points from Livingston and Monroe counties
31 scrapers
13 clay pipe bowls
7 fragments of pipe bowls
1 stone maskette
1 stone tube, highly polished, from Hemlock lake
1 depressed center-perforated discoidal stone
1 rare bone comb from Richmond Mills
7 perforated brass arrow points
10 triangular brass points from Totiacton
1 polished slate knife, rare specimen, from Avon
1 polished slate knife, chipped edges
1 winged and notched object of stone
2 bone draw scrapers
11 flints from Monroe county
20 flints from Monroe county
254 flint points from the Genesee valley
24 notched shouldered points from the Genesee valley

**Spear, William A.** Findley Lake, N. Y.
1 stone press, Indian make, from Ripley Crossing
1 stone hammer of polished black and white marble from Mina
1 black polished *chunkee* stone, from Gage's Gulf
1 grooved war club stone from Findley lake
1 chisel celt from Findley lake
1 celt chisel from Mina

3 celts from Ripley
1 moccasin last from French creek
1 adz from Chautauqua lake
2 gorgets from Clymer
1 celt from Mina
1 small pestle from Ripley
1 mottled stone pestle from Ripley
5 celts from French creek
1 celt from Mina
1 large quarry flake from Mina
1 large war club head from Findley lake
2 celts from Clymer
3 celts from Findley lake
1 obtuse edged celt from Erie (Pa.)
2 small celts from Ripley
1 large flake from Findley lake
1 bar celt from Mayville. A rare specimen
2 celts from Chautauqua
1 gorget from French creek
1 miniature pestle or plummet from French creek
6 celts from Chautauqua county
1 polished pipe with human face and deer's hoof from Findley lake
1 polished cup of oolitic limestone (Ind.) from Hauger farm, Findley lake
1 disk stone
50 flint points from Chautauqua county
1 varicolored jasper knife from Chautauqua
10 flint spearheads from Chautauqua
3 iron tomahawks from Lake Erie trail
1 wooden war club carved from curly maple. Picked up at Herkimer after the Indian raid of 1791. Exceptionally fine specimen

**Amidon,** *Dr* **R. W.** Chaumont, N. Y.

BONE ARTICLES FROM ST LAWRENCE COUNTY

4 bone awls made from bone splinters. Large specimens. St Lawrence county
4 bone harpoons from St Lawrence county
1 inscribed awl. Fine specimen from St Lawrence county
1 finely pointed cylindrical bone awl or broken harpoon. St Lawrence county
2 heavy bone splinter awls or spears. St Lawrence county
1 flat bone knife
1 tubular awl
3 splinter awls, broken
2 flat awls, rude specimens
1 portion of bone knife
1 cylindrical bone awl with broken tip
1 incised walrus bone harpoon
1 bone harpoon showing scratches made when object was in process

5 awl points
1 polished cylindrical awl
1 harpoon
1 bone gouge and scraper
1 broken awl point
1 barbed harpoon. Fine specimen
3 chipped bone implements
1 fragment of perforated human skull
1 perforated and inscribed bone
5 awls
1 spatulate implement, small
1 awl of bear's jaw with teeth
1 inscribed bone knife point
2 needles
1 semicarbonized bone knife point with incised marks
3 awl points
1 metatarsal bone
4 perforated and smoothed deer phalanges
1 panther claw
4 inscribed bone knives
2 long bone awls
3 harpoons
1 barbed harpoon
4 worked bones
2 flat awllike knives
3 worked antler points
8 rude awls
25 pieces of worked bone
3 fragments of bone knifes
4 awl points
1 Eskimoan awl
2 fragments of Eskimoan awls
2 rubbed and pointed bones
3 pieces worked walrus bone
4 antler points
8 bone beads of various sizes

BONE OBJECTS FROM PERCH RIVER

4 pieces of worked bone
1 piece of worked antler
16 bone awls of various sizes and forms
1 needle point
1 elk tooth pendant
10 pieces of worked bone
1 awl made from jaw of small rodent
1 bone knife fragment, Eskimoan
1 lot of sherds from Champlain
1 lot of worked bone
1 lot of pipe pottery from Duck Harbor
1 lot of pottery of Algonkin pattern

1 lot of animal bones
1 lot of pottery fragments from Perch river
1 lot of antler and bone objects
1 lot marked VII containing sherds
1 lot of Algonquin sherds
1 lot of animal bones
1 lot of potsherds from Rutland Hollow
1 lot of potsherds
1 lot of water-washed stones
1 lot of pipe pottery from St Lawrence county
7 articles of worked flint
5 bone awls
2 bear teeth
3 pitching tools
1 bone tube
5 specimens of worked stone
1 stone pick
1 rude celt
2 celts from Point Salubrious
2 celts from Perch river
1 stone cylinder
1 shell bead from ossuary
1 *busycon* cone bead
1 shell bead
16 triangular flint points
1 remnant of pottery coil which was bitten while soft by an Indian child when it was thrown into the fire and baked. Shows imprint of four lower incisors which were irregular.
1 pottery pipe, Perch river. Rare specimen

**Wienert, E.** Albany. 1 grooved axe of serpentine. Unusual form, from town of Duanesburg, Schenectady co.

**Collection**

**Parker, Arthur C.**

FROM BURNING SPRING FORT, DURING THE SUMMER OF 1905

Fragments of pottery, arrow points, flint chips, bones and charcoal
Charred grass from grave
Arrow points
Bones, chips etc. from a pit on High Banks
10 fish net sinkers
12 celts or stone axes
8 pestles
14 stone articles (round) used perhaps as hammer stones
1 perforated stone
2 stones used perhaps for striking fire
1 scraper made of stone
Miscellaneous stone articles
Fragments of an earthenware pot

Fragments of pottery picked up on surface of Burning Spring site
1 cigar box containing flint objects: drills, scrapers, war points, hunting points, arrowheads etc.

FROM THE ERIE INDIAN VILLAGE, FORT AND BURIAL GROUND NEAR RIPLEY, CHAUTAUQUA CO., N. Y. DURING THE SUMMER AND AUTUMN OF 1906

STONE OBJECTS

1 stone mortar from ash pit 50
1 stone pipe, claw-shaped, from grave 105
1 stone pipe with stem, from grave 140
1 stone pipe with stem neck from grave 141
1 stone pipe bowl, Wisconsin form, from ash pit 26
1 oval stone pipe, Wisconsin form, from top soil. Trench 5
1 animal form pipe from grave 92
1 bar celt from grave 96
1 double edged celt from grave 92
1 celt from grave 132
1 celt from grave 100
4 celts found in fire pit 80
1 celt edge from ash pit 83
1 celt broken in process from trench 12
1 celt from grave 92
1 celt from grave 11
1 celt from knoll opposite site
1 rude celt from pit 32
1 small celt from ash pit 32
2 miniature celts edged from natural pebble. Ash pit 78
1 miniature celt edged from natural pebble. Ash pit 77
1 chisel-edged stone from ash pit 78
1 celt or edged stone from grave
10 triangular flint points from grave 139
4 triangular flint points from grave 117
10 triangular flint points from grave 120
8 triangular flint points from grave 96
6 triangular flint points from grave 94
1 long triangular flint from grave 78
1 triangular flint point from pit 78
1 yellow jasper triangular point from pit 55
2 flint triangular points from pit 50
8 flint triangular points from grave 63
5 flint triangular points from grave 64
7 triangular flint points from ash pit 32
4 triangular flint points from ash pit 34
4 triangular flint points from ash pits, various
1 flint perforator from grave 133
1 spear and 1 knife of flint from grave 133
3 flint scrapers from grave 133
5 flint chips from grave 133
1 flint knife from grave 139

1 translucent white spearhead from grave 120
2 flint knives from grave 120
1 translucent white spearhead from grave 120
1 black flint knife from grave 94
1 bunt point from ash pit 78
1 flint scraper from ash pit 50
1 flint knife from ash pit 35
1 flint blade from ash pit 21
1 oval blade from grave 10
1 flint object from grave
3 flint knives from grave 63
3 net sinkers from surface
1 hammer stone from trench 14
1 hammer stone from ash pit 83
1 hammer stone from ash pit 50
2 hammer stones from ash pit trench 3
1 worked stone from grave 63
1 worked stone from trench 18
1 grooved shaft rubbing stone from ash pit 83
1 worked stone from grave 120
1 chopper or digging stone from trench 12

POTTERY OBJECTS

1 pottery vessel from grave 140
1 pottery vessel from grave 119
1 large clay pot from grave
1 clay pot, corded decoration from grave 128
1 clay pot, corded decoration from grave 126
1 pottery vessel from grave
1 broken clay pot from grave 112
1 clay pot from grave 106
1 pottery vessel, wide mouth, from grave 100
1 clay pot with pitcher nose from grave 113
1 pottery vessel from grave
1 pottery vessel from grave 107
1 red clay pot from grave 105
1 small terra cotta vessel from grave 96
1 clay pot from grave 96
1 pottery cup from grave 96
1 pottery vessel from grave 87
1 pottery vessel from grave 88
1 pottery vessel from grave 92
1 pottery vessel from grave 86
1 pitcher-shaped pot from grave 69
1 pottery vessel and pipe from grave 62
1 clay pot from grave 62
1 pottery vessel from grave 65
1 pottery vessel from grave 51
1 pottery vessel from grave 48 (Restored)
1 small clay pot from ash pit 17

1 clay pot from grave 23
1 pottery vessel in fragments from grave 58
1 pottery vessel from trench 9
1 pottery vessel from grave 4
1 red terra cotta pipe, with nipple for stem, from grave 9
1 pottery pipe with a face on front and back, from grave 44
1 clay pipe from grave 51
1 terra cotta pipe bowl from ash pit 31
1 terra cotta pipe from grave 120
1 bear's head pipe bowl fragment from ash pit 82
1 pot rim fragment
3 pot points from pit 50
1 broken pot from grave 47
1 broken pot from grave 40
1 pot rim point from ash pit 42
1 potsherd with color band decorations from pit 33
2 pot points from ash pit 34
1 fabric-marked sherd from ash pit 32
2 pot points from ash pit 32
1 top of pipe bowl from surface
1 broken pipe bowl from trench 4
1 pipe bowl fragment from trench 11
1 fragment of pipe bowl, clay in process from trench 11
1 pipe stem from ash pit 74
1 trumpet-shaped pipe from grave 86
1 piece of pipe stem from surface

PIGMENTS

1 piece of black graphite from grave 133
2 pieces of black pigment from grave 120
1 lump of red pigment from grave 96

METALLIC OBJECTS

1 broken copper ring from grave 133
1 brass bead from grave 139
1 copper bead with section of original thong from grave 96
1 portion of copper arm band from ash pit 16
1 iron ax edge from grave 133
1 iron-stained stone from pit 32
1 rectangular iron bar from ash pit 32

ANTLER OBJECTS

1 pitching tool from grave 133
1 flaking tool from grave 133
1 anther punch from ash pit
1 antler hoe from ash pit 55
1 pitching tool from ash pit
1 antler implement with spatulate end from ash pit 50
1 pitching tool from ash pit 50
1 antler implement from ash pit 50

1 antler chisel from pit 16
1 hollowed antler punch from ash pit 79
1 antler spade or hoe from pit 21
1 antler chisel from pit 34
1 section of antler showing cutting from ash pit 38

BONE OBJECTS

3 bone awls from pit 84
1 bone awl from ash pit 79
5 bone awls from ash pit 74
4 bone awls from ash pit 75
1 tubular bone awl from ash pit 75
1 bone awl from ash pit 71
1 awl point from ash pit 70
1 awl from ash pit 70
3 awls from ash pit 50
2 rude awls from ash pit 46
1 large awl from ash pit 42
1 awl with broken tip from ash pit 42
1 awl from ash pit 35
1 bone needle fragment from pit 35
2 bone awls from pit 21
4 awls from pit 28
1 bone awl from ash pit 3
3 bone awls from ash pit 2
1 bone awl from ash pit 19
1 bone awl from ash pit 31
7 awls from ash pit 32
1 awl from ash pit 34
1 awl point from ash pit 38
2 tubular beads from ash pit 82
1 polished bone bead from pit 81
2 rude bone beads from ash pit 78
2 polished beads from ash pit 76
2 bone beads from pit 55
3 bone beads from ash pit 50
1 tubular bone bead from ash pit 46
8 bone beads from ash pit 86
1 broken bead from pit 45
1 short bead from ash pit 46
2 tubes of bone from ash pit 41
1 bone tube from ash pit 46
1 bone tube from ash pit 35
4 bone beads from ash pit 21
3 bone beads from ash pit in trench 1
5 bone beads from ash pit 28
6 bone beads from ash pit 3
1 bead

5 bone beads from ash pit 1
5 bone beads from ash pit 21
1 bone bead from ash pit 31
5 bone beads from ash pit 32
1 bone bead from ash pit 32
1 bone tube in process
1 bone bead from ash pit 53
1 smoothed deer's phalanx from ash pit 75
1 smoothed deer's phalanx from ash pit 76
4 smoothed deer's phalanges from ash pit 46
1 conical perforated phalanx from pit 34
1 portion of worked phalanx from ash pit 34
1 worked bone from ash pit 78
1 serrated rib from ash pit 78
1 long tube bead from ash pit 78
1 bone punch from ash pit 55
1 smoothed bone grooved on either side from ash pit 50
1 smoothed bone from ash pit 50
1 notched bone pendant from ash pit 21
1 bone shuttle from ash pit 29
1 fragment of tortoise shell cup, perforated, from ash pit 34
1 hollow handlelike bone from ash pit 34
1 bone plug from ash pit 32
1 worked bone from ash pit 38
1 worked deer phalanx from ash pit 79
1 smoothed phalanx from ash pit 74
1 scratched animal femur
4 incised bones from ash pit 38
1 perforated deer's tooth from ash pit 117
1 worked beaver tooth from ash pit 84
1 worked beaver tooth from ash pit 79
1 worked beaver tooth from ash pit 70
1 perforated elk's tooth from ash pit 55
1 tooth, perforated, from ash pit 50
1 bear tooth from ash pit 34
3 sections of a bone needle from ash pit 80
1 bone needle, broken, from ash pit 21
1 broken bone needle from ash pit 29
2 ear bones from "sheep-head" perch from ash pit 2
2 ear bones from "sheep-head" perch from ash pit 46
1 fish head game button from ash pit 77
1 polished racoon penis bone from ash pit 50

### HUMAN REMAINS

Parts of 75 skeletons

### OBJECTS OF SHELL

1 shell gorget found in grave 133
Various fragments of shell beads from grave 133

10 fragments of an incised shell from grave 133
50 discoidal beads found about neck of skeleton 133
1 shell pendant from grave 133
1 perforated unio shell from ash pit 46
1 discoidal bead from ash pit 21
1 shell bead from ash pit 3
50 snail shells, (Helix alternata) from pit

### OBJECTS OF WOOD OR OTHER VEGETABLE SUBSTANCES

1 section of pipe stem preserved by carbonization
1 charred corn cob from ash pit 81
Decayed wood from grave 11
Quantity of charred corn from ash pit 32

### MISCELLANEOUS

Objects from ash pits; 10 boxes

### OTHER ARCHEOLOGICAL SPECIMENS COLLECTED IN THE FIELD 1906

1 pot rim fragment from Rochester Junction
1 celt in process from mouth of Cattaraugus
1 grooved ax from Burning Spring trail
1 notched flint point from Burning Spring trail. Rare form
1 pitted stone from Brant sand hill
5 potsherds from Burning Spring
1 piece of stone gorget from mouth of Cattaraugus creek
1 flint drill from mouth of Cattaraugus
1 triangular flint point from mouth of Cattaraugus
1 fragment of pipe stem
3 shouldered flints from mouth of Cattaraugus
1 flint drill from Burning Spring
1 yellow jasper flake from mouth of Cattaraugus
1 triangular blade from mouth of Cattaraugus
1 greenish yellow chip from mouth of Cattaraugus
1 perforated triangular arrow point of brass from Rochester Junction

Total .............................................. 3495+

X

# Appendix A

## NEW ENTRIES ON GENERAL RECORD OF LOCALITIES OF AMERICAN PALEOZOIC FOSSILS BELONGING TO STATE MUSEUM

### Alphabetic list of localities



### New York localities according to counties

Names in italics are new to the record.

ALBANY CO.
South Westerlo

ALLEGANY CO.
Alfred
Almond

CATTARAUGUS CO.
Olean

CAYUGA CO.
*Aurelius*
Aurora
*Cross Roads*
Genoa
*Oakwood*
*Payne's creek*
Salmon creek

DELAWARE CO.
Delhi

HERKIMER CO.
Jerusalem Hill
North Litchfield

MONROE CO.
East Rochester
Genesee river
Pittsford
Rochester
*South Greece*
"Spring House"

ONTARIO CO.
Naples
Parrish gully

ORANGE CO.
*Otisville*

SCHUYLER CO.
*Breakneck creek*
North Hector
Valois

SENECA CO.
Lodi
Lodi creek
Lodi glen
Lodi point

TOMPKINS CO.
Ithaca

## Index to formations



## Record of new localities

3495 Rochester shale. Excavation for barge canal 2 miles east of South Greece railroad station, Monroe co. H. C. Wardell, coll. 1905

3496 Upper Siluric. Cincinnati, O. Dr Fr. Coppi purchase, 1906.

3497 Trenton group. Stone river, Tenn. Dr Fr. Coppi purchase, 1906

3498 Hamilton beds. South Westerlo, N. Y. Ross Morehouse, donor, 1906

3499 Guelph dolomite. Excavation for new high school, Rochester, N. Y. C. A. Hartnagel, donor, 1906

3501 Upper Clinton. Genesee gorge, Rochester, N. Y. C. A. Hartnagel, donor, 1906

3502 Cashaqua beds. Parrish gully, Naples, N. Y. D. D. Luther, coll. 1905

3503 Genesee beds, top of. 3 miles south of Genoa on Salmon creek, Cayuga co., N. Y. D. D. Luther, coll. 1905

3504 Lower Portage beds. North ravine at Lodi point, Seneca lake, N. Y. 780′ A. T. D. D. Luther, coll. 1905

3505 Genesee beds, top of. 2½ miles south of Genoa village, N. Y. at the forks of Salmon creek near an old mill. D. D. Luther, coll. 1905

3506 Ludlowville shale. Aurora, N. Y. Payne's creek at about 420′ A. T. 50 to 100 feet below Tichenor limestone. D. D. Luther, coll. 1905

3507 Portage beds. Valois (North Hector) N. Y. at 600 ft A. T. in Breakneck creek ravine. Horizon 175 ft (est.) above base of the Portage. D. D. Luther, coll. 1905

3508 Portage beds. Valois (North Hector) N. Y. In Breakneck creek ravine at 540′ A. T. Horizon 120 ft (est.) above base of Portage. D. D. Luther, coll. 1905

3509 Portage beds. Lodi Glen, 800 to 820 ft A. T. D. D. Luther, coll. 1905

3510 Hatch shale. Lodi creek 1 mile south of Lodi village at 1050′ A. T. D. D. Luther, coll. 1905

3511 Upper Carbonic. Mazon creek, Grundy co., Ill. Dr F. Krantz, purchase, 1906

3512 Richmond beds. Lebanon, O. Ward's Natural Science Establishment, purchase, 1906
3513 Drift (Siluric ?). Charles Mix county, S. D. Ward's Natural Science Establishment, purchase, 1906
3514 Trenton group. Ontario, Can. Ward's Natural Science Establishment, purchase, 1906
3515 Trenton group. Collingwood, Ontario, Can. Ward's Natural Science Establishment, purchase, 1906
3516 Bertie waterlime. Cross Roads, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5
3517 Onondaga limestone. Cliff north of Oakwood, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5
3518 Rochester shale. Rochester, N. Y. C. A. Hartnagel, coll. 1901–5
3519 Clinton beds (lower limestone). Genesee river, Rochester, N. Y. C. A. Hartnagel, coll. 1901–5
3520 Clinton beds (top of lower green shale). Rochester, N. Y. C. A. Hartnagel, coll. 1901–5
3521 Cobleskill limestone. Stony Pitch near Aurelius, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5
3522 Lockport dolomite. Brink of upper falls Genesee, river, Rochester, N. Y. C. A. Hartnagel, coll. 1901–5
3523 Salina beds, base of. "Spring House" Pittsford, N. Y. R. Ruedemann & H. C. Wardell, coll. 1906
3524 Clinton beds. Genesee gorge, Rochester, N. Y. H. C. Wardell, coll. 1906
3525 Bertie limestone. Maxwell's farm, Jerusalem Hill, Herkimer co., N. Y. H. C. Wardell, coll. 1906
3526 Shawangunk grit. Erie R. R. crusher quarry, Otisville, N. Y. H. C. Wardell, coll. 1906
3527 Wolf creek conglomerate. Cattaraugus co., N. Y. Charles Butts, coll.
3528 Chemung beds. Alfred, N. Y. Charles Butts, coll.
3529 Chemung beds. Olean, N. Y. Charles Butts, coll.
3530 Chemung beds. Almond, N. Y. Charles Butts, coll
3531 Chemung beds. Chatham, Tioga co., Pa. Charles Butts, coll.
3532 Chemung beds. Keneyville, Tioga co., Pa. Charles Butts, coll.
3533 Kinzua sandstone. Tioga co., Pa. Charles Butts, coll.
3534 Helderbergian. Salisbury's quarry, North Litchfield, Herkimer co., N. Y. H. C. Wardell, coll. 1906
3535 ........... Prince or Salt works cave southwest side of Moose island, Washington co., Me. O. O. Nylander, coll. 1906
3536 ........... Point just south of Broad cove, west side of Moose island, Washington co., Me. O. O. Nylander, coll. 1906
3537 ........... Shackford head north side of Broad cove, Moose island, Washington co., Me. O. O. Nylander, coll. 1906
3538 ........... North part Carlo's island, St Croix river, Washington co., Me. O. O. Nylander, coll. 1906
3539 ........... Southwest part of Carlo's island, St Croix river, Washington co., Me. O. O. Nylander, coll. 1906

3540 ............ Pleasant point, Washington co., Me. O. O. Nylander, coll. 1906

3541 ............ Mouth of Little river (west side), Washington co., Me. O. O. Nylander, coll. 1906

3542 ............ Pigeon hill, between Perry and Eastport, Washington co., Me. O. O. Nylander, coll. 1906

3543 ............ Birch point, extreme southern point of the town of Perry, Washington co., Me. O. O. Nylander, coll. 1906

3544 ............ West side of the head of Pennamaguan bay, Washington co., Me. O. O. Nylander, coll. 1906

3545 ............ Farm of G. Hilton. 3 miles south of West Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3546 ............ On farms of Ezra Leighton and Isaac Leighton, 4 miles south of West Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3547 ............ Schooner cove (east side), town of Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3548 ............ Falls point, extreme southern point of town of Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3549 ............ King David's lodge. Town of Dennysville, Washington co., Me. O. O. Nylander, coll. 1906

3550 ............ On farm of Joseph Bell. Southwestern part of town of Edmunds, Washington co., Me. O. O. Nylander, coll. 1906

3551 ............ Northern end of Moose island, Washington co., Me. O. O. Nylander, coll. 1906

3552 ............ Denbow point, northern point of town of Lubec, Washington co., Me. O. O. Nylander, coll. 1906

3553 ............ Rogus island, town of Lubec, Washington co., Me. O. O. Nylander, coll. 1906

3554 Devonic limestone. Cove at Owl's Head landing, Memphremagog lake, Quebec, Can. R. Ruedemann, coll. 1906

3555 Devonic shale. Grove creek, 1 mile west of Knowlton's Landing, Memphremagog lake, Quebec, Can. R. Ruedemann, coll. 1906

## Record of foreign localities

Specimens bearing lemon yellow tickets

162 Upper Siluric. Konieprus, Bohemia. Fr. Coppi, purchase

163 Upper Siluric. Bohemia. Fr. Coppi, purchase

164 Upper Siluric. Tetin, Bohemia. Fr. Coppi, purchase

165 Upper Siluric. Dlouha hora, Bohemia. Fr. Coppi, purchase

166 Upper Siluric. Lochkow, Bohemia. Fr. Coppi, purchase

167 Lower Siluric. Vesela, Bohemia. Fr. Coppi, purchase

168 Lower Siluric. Bohemia. Fr. Coppi, purchase

169 Lower Siluric. Andrarum, Sweden. Fr. Coppi, purchase

170 Upper Siluric. Kolednik, Bohemia. Fr. Coppi, purchase

171 Lower Siluric. Oeland, Sweden. Fr. Coppi, purchase

172 Upper Siluric. Gotland, Sweden. Fr. Coppi, purchase

173 Upper Siluric. Wenlock limestone. Dudley, England. Fr. Coppi, purchase

174 Lower Siluric. Zahoran, Bohemia. Fr. Coppi, purchase
175 Silurian (schiste ardoisier). Trélazé, near Angers, France. Fr. Coppi, purchase
176 Upper Siluric. St Ivan, Bohemia. Fr. Coppi, purchase
177 Siluric. Vaques, Calvados, France. Fr. Coppi, purchase
178 Lower Devonic. Bundenbach, Rhenish Pr. F. Krantz, purchase
179 Lower Siluric. Christiania, Norway. F. Krantz, purchase
180 Cambric. Skrey, Bohemia. F. Krantz, purchase
181 Lower Siluric. Pulkowka river, Kusmino near St Petersburg, Russia. F. Krantz, purchase
182 Cambric. Skrey, Bohemia. F. Krantz, purchase
183 Siluric. Leitschkow, Bohemia. F. Krantz, purchase
184 Upper Cambric. Skrey, Bohemia. F. Krantz, purchase
185 Middle Devonic. Terques, Pas de Calais, Fr. Jean Miguel, exchange
186 Upper Devonic. S. Nazaire, Hérault, Fr. Jean Miguel, exchange
187 Middle Devonic. Trasmiers, Terques Pas de Calais, France. Jean Miguel, exchange
188 Lower Devonic. Nehou, Manche, France. Jean Miguel, exchange
189 Lower Devonic. La Baconnière, Mayenne, France. Jean Miguel, exchange.
190 Middle Devonic (Eifelian). Le Mont Peyoux, Herault, France Jean Miguel, exchange
191 Upper Devonic. Cabrières, Herault, France. Jean Miguel, exchange
192 Lower Devonic. S. Germain le Touilly, Fr. Jean Miguel, exchange
193 Carbonic. Dudley, England. F. Krantz, purchase
194 Upper Siluric. Hostin, Bohemia. F. Krantz, purchase
195 Upper Siluric. Dudley, England. F. Krantz, purchase
196 Siluric. Bala, Northern Wales. F. Krantz, purchase
197 Siluric. Kuchelbad, Bohemia. F. Krantz, purchase
198 Lower Siluric. Mortain, France. F. Krantz, purchase
199 Carbonic. Eskdale, New Brunswick. F. Krantz, purchase
200 Upper Siluric. Rötziküll, Island of Oesel, Livland, Russia. F. Krantz, purchase
201 Lower Siluric. County Tyrone, Ireland. F. Krantz, purchase
202 Lower Siluric. Ostergotland, Sweden. F. Krantz, purchase
203 Upper Siluric. Gotland, Sweden. F. Krantz, purchase
204 Upper Siluric. Lodenitz, Bohemia. F. Krantz, purchase
205 Lower Siluric. Vitré Ille et Vilaine, France. F. Krantz, purchase
206 Lower Devonic. Winnigen on the Moselle, Rhenish Prussia. F. Krantz, purchase
207 Lower Siluric. Girvan, Scotland. F. Krantz, purchase
208 Siluric. Dudley, England. F. Krantz, purchase
209 Lower Coblentz. Oberstadtfeld, Germany. Fr. Drevermann, donor
210 Middle Devonic. Pelm, Eifel, Germany. Fr. Drevermann, donor
211 Lower Coblentz. Singhofen, Germany. Fr. Drevermann, donor
212 Middle Devonic. Ahrhütte, Eifel, Ger. Fr. Drevermann, donor
213 Middle Devonic. Lissingen, Germany. Fr. Drevermann, donor
214 Middle Devonic. Gerolstein, Germany. Fr. Drevermann, donor
215 Middle Devonic. Gondelsheim, Eifel, Ger. Fr. Drevermann, donor
216 Middle Devonic. Schmidtheim, Eifel, Ger. Fr. Drevermann, donor

217 Middle Devonic. Auburg, Eifel, Germany. Fr. Drevermann, donor
218 Siluric. Lion, Loire Inferieure, France. F. Krantz, purchase
219 Siluric. Saille, Ille et Vilaine, France. F. Krantz, purchase
220 Siluric. St Chinian, Herault, France. F. Krantz, purchase
221 Siluric. Travenzot, Sarthe, France. F. Krantz, purchase
222 Siluric. Guichen, Ille et Vilaine, France. F. Krantz, purchase
223 Precambric. Oeland, Sweden. F. Krantz, purchase
224 Cambric. Herault, France. F. Krantz, purchase
225 Lower Devonic. Bundenbach, Rheinland, Ger. F. Krantz, purchase
226 Cambric. Tremadoc. North Wales, Eng. F. Krantz, purchase
227 Siluric. May, France. F. Krantz, purchase
228 Lower Devonic. Stadfeld, Daun, Eifel, Rhenish Prussia. F. Krantz, purchase
229 Siluric. Dudley, England. F. Krantz, purchase
230 Carbonic. Clitheroe, Lancaster, England. F. Krantz, purchase
231 Lower Siluric. Osek, Bohemia. F. Krantz, purchase
232 Lower Siluric. Sadewitz, Silesia, Germany. F. Krantz, purchase
233 Siluric. Lodewitz, Bohemia. F. Krantz, purchase
234 Hercynian. Konieprus, Bohemia. F. Krantz, purchase
235 Devonic. Herault, France. F. Krantz, purchase
236 Siuric. St Benigne, Bohemia. F. Krantz, purchase
237 Lower Siluric. Beraun, Bohemia. F. Krantz, purchase
238 Devonic fossils from Tibagy, Paraná, Brazil. I. C. White, donor
239 Devonic fossils. Jaguaryhiva, Paraná, Brazil. I. C. White, donor
240 Devonic fossils. Ponta Grossa, Paraná, Brazil. I. C. White, donor
241 Devonic Fossils. Near Pará, Brazil. I. C. White, donor
242 Upper Siluric. Lodewitz, Bohemia. F. Krantz, purchase
243 Siluric. Dudley, England. F. Krantz, purchase
244 Lower Siluric. Podcaple, Bohemia. F. Krantz, purchase
245 Siluric. Lodewitz, Bohemia. F. Krantz, purchase
246 Hercynian. Koniéprus, Bohemia. F. Krantz, purchase
247 Lower Devonic. Maecurú river, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
248 Middle Siluric. Rio Trombetas, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
249 Lower Devonic. Rio Curuá, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
250 Lower Devonic. Ereré, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
251 Devonic. Ponta Grossa. State of Paraná, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
252 Devonic (?) Colonia Thereza, State of Paraná, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
253 Coal Measures. Itaitubá, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
254 Triassic (?) Piracicaba. State of Sao Paulo, Brazil. O. A. Derby & J. M. Clarke, donors

# Appendix B

CATALOGUE OF

## TYPE SPECIMENS OF PALEOZOIC FOSSILS

**Supplement 3**

The general classified list, covering 5159 numbers, was published as Museum bulletin 65. Supplement 1 was published as part of the annual report of the Paleontologist 1903. Supplement 2 was published as part of the report of the Director 1904.

### PLANTAE

ARTHROPHYCUS Hall

**Arthrophycus harlani** Conrad (sp.)

6176 $\frac{120}{3}$ HYPOTYPE Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2:92.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. facing p. 4.
Siluric. Oiteiro do Cachorra, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### COELENTERATA

#### SPONGIAE

**Hexactinellid sponge** (spicules of)

6177 $\frac{2310}{1}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 4, pl. 1, fig. 23.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J M. Clarke, donors

6178 $\frac{2310}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 24.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

#### CNIDARIA

ALVEOLITES Lamarck

**Alveolites goldfussi** Billings

6179 $\frac{3021}{1}$ HYPOTYPE Billings. Canadian Journal. n. s. 1860. 5:255.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 14, fig. 5, 8.

Hamilton beds. York, Livingston co. N. Y.

C. Van Deloo, coll. 1865

6180 $\frac{3021}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 14, fig. 6, 7, 9.

Hamilton beds.

Norton's landing, Cayuga lake, N. Y.

H H. Smith, coll. 1871

Astrea stylopora *see* Michelinia (Pleurodictyum) stylopora

Calamopora hemisphericus *see* Favosites hemisphericus

Calamopora maxima *see* Michelinia (Pleurodictyum) maxima

CHAETETES Fischer

**Chaetetes fruticosus** Hall

6181 $\frac{3143}{1}$ TYPE Chaetetes fruticosus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 38; pl. 38, fig. 1.

Hamilton beds Canandaigua lake, N. Y.

R. P. Whitfield & J. W. Hall, coll. 1858

6182 $\frac{3143}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 38, fig 2, 4.

Hamilton beds Canandaigua lake, N. Y.

R. P. Whitfield & C. Van Deloo, coll. 1862

6183 $\frac{3143}{3}$ TYPE Hall. Illustrations of Devonian Fossils. 1876. Corals, pl. 38 fig 5.

Hamilton beds Western New York

**Chaetetes furcatus** Hall

6184 $\frac{3144}{1}$ TYPE Chaetetes furcatus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 37; pl. 37, fig. 1, 3. (Part of specimen)

Hamilton beds

Norton's landing, Cayuga lake, N. Y.

H. H. Smith, coll. 1871

6185 $\frac{3144}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 2, 4.
Hamilton shale
Norton's landing, Cayuga lake, N. Y.
H. H. Smith, coll. 1871

6186 $\frac{3144}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 5.
Hamilton beds
Norton's landing, Cayuga lake, N. Y.

6187 $\frac{3144}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 38, fig. 7.
Hamilton beds Bellona, Yates co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

**Chaetetes humilis** Hall

6188 $\frac{3145}{1}$ TYPE Chaetetes humilis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 37; pl. 37, fig. 11, 12.
Onondaga limestone Western New York

6189 $\frac{3145}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 13, 14.
Onondaga limestone Western New York

6190 $\frac{3145}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 15.
Onondaga limestone Western New York

**Chaetetes tenuis** Hall

6191 $\frac{3146}{1}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 9, 10.
Onondaga limestone Stafford, Genesee co. N. Y.

CYSTIPHYLLUM Lonsdale

**Cystiphyllum americanum** Milne-Edwards & Haime

6192 $\frac{3281}{1}$ HYPOTYPE Milne-Edwards & Haime. Polyp. Foss. Terr. Palaeozoiques. 1851. p. 464.
Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 28, fig. 2.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

6193 $\frac{3281}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 28, fig. 5.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

**Cystiphyllum conifollis** Hall

6194 $\frac{3282}{1}$ **TYPE** Cystiphyllum conifollis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 30; pl. 30, fig. 3.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

**Cystiphyllum varians** Hall

6195 $\frac{3280}{5}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 29, fig. 6.
Hamilton beds. Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6196 $\frac{3280}{6}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 29, fig. 7–9.
Hamilton beds York, Livingston co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

FAVOSITES Lamarck

**Favosites arbusculus** Hall

6197 $\frac{3420}{2}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 2.
Hamilton beds Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6198 $\frac{3420}{3}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 3.
Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6199 $\frac{3420}{4}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 4.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

6200 $\frac{3420}{5}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 6.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

6201 $\frac{3420}{6}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 8
Hamilton beds — York, N. Y.
C. Van Deloo, coll. 1865

**Favosites ? argus** Hall

6202 $\frac{3425}{1}$ TYPE Favosites ? argus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 13; pl. 13, fig. 1.
Hamilton beds — York, N. Y.
C. Van Deloo, coll. 1865

6203 $\frac{3425}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 2.
Hamilton beds — Darien, Genesee co. N. Y.
C. A. White & C. Van Deloo, coll. 1860–61

6204 $\frac{3425}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 3.
Hamilton beds — York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6205 $\frac{3425}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 5, 7.
Hamilton beds — York, N. Y.
C. A. White & C. Van Deloo, coll. 1860

6206 $\frac{3425}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 6.
Hamilton beds — Bellona, Yates co. N. Y.
J. W. Hall & C. Van Deloo, coll. 1866

6207 $\frac{3425}{6}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 8.
Hamilton beds — York, N. Y.
C. Van Deloo, coll. 1865

6208 $\frac{3425}{7}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 9.
Hamilton beds — York, N. Y.
C. Van Deloo, coll. 1865

**Favosites emmonsi** Hall

6209 $\frac{3426}{1}$ TYPE Favosites emmonsi Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 9; pl. 9, fig. 1.
Onondaga limestone Cayuga, Ontario, Can.
J. De Cew, coll. 1866

6210 $\frac{3426}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 2.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6211 $\frac{3426}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 3, 4.
Onondaga limestone Williamsville, Erie co. N. Y
R. P. Whitfield, C. A. White & C. Van Deloo, coll. 1860

6212 $\frac{3426}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 5.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6213 $\frac{3426}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 6.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6214 $\frac{3426}{6}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 5.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6215 $\frac{3426}{7}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 4.
Onondaga limestone Falls of the Ohio

6216 $\frac{3426}{8}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 5.
Onondaga limestone Williamsville, Erie co. N. Y.
C. A. White, coll. 1860

**Favosites epidermatus** Rominger

6217 $\frac{3427}{1}$ HYPOTYPE Favosites epidermatus Rominger. American Journal of Science. 1862. 34:396.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 6, fig. 3, 4.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6218 $\frac{3427}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 6, fig. 5.
Onondaga limestone
Caledonia, Livingston co. N. Y.
C. A. White, coll. 1860

6219 $\frac{3427}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 9.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites epidermatus** Rominger *var.* **corticosus** Hall

6220 $\frac{3428}{1}$ TYPE Favosites epidermatus var. corticosus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 10; pl. 10, fig. 1.
Onondaga limestone Western New York

6221 $\frac{3428}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 10, fig. 6.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites (Michelinia?) explanatus** Hall

6222 $\frac{3429}{1}$ TYPE Favosites (Michelinia?) explanatus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 14; pl. 14, fig. 1–4.
Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

**Favosites hamiltonensis** Hall

6223 $\frac{3429a}{1}$ TYPE Favosites hamiltonensis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 34; pl. 34, fig. 1, 2.
Hamilton beds Aurora, Cayuga co. N Y.
G. B. Simpson, coll. 1863

6224 $\frac{3429a}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 4.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6225 $\frac{3429a}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 5.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6226 $\frac{3429a}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 8.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6227 $\frac{3429a}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876 Corals, pl. 34, fig. 9.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

**Favosites hemisphericus** Troost (sp.)

6228 $\frac{3429b}{1}$ HYPOTYPE Calamopora hemispherica Troost. Fifth Geological Report of Tennessee. 1840. p. 72.
Favosites hemisphericus Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 6.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

**Favosites hemisphericus** Troost *var.* **a** Hall

6229 $\frac{3429c}{1}$ TYPE Favosites hemisphericus var. a Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 2A; pl. 2A, fig. 6.
Onondaga limestone Falls of the Ohio
S. S. Lyon, coll.

6230 $\frac{3429c}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 2A, fig. 7.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

**Favosites hemisphericus** Troost *var.* **distortus** Hall

6231 $\frac{3429d}{1}$ TYPE Favosites hemisphericus var. distortus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 5; pl. 5, fig. 1.
Onondaga limestone Schoharie co. N. Y.
J. Gebhard jr purchase, 1872

**Favosites hemisphericus** Troost *var.* **rectus** Hall

6232 $\frac{3429e}{1}$ TYPE Favosites hemisphericus var. rectus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 2C; pl. 2C, fig. 1, 2.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6233 $\frac{3429e}{2}$ TYPE Hall. Illustrations of Devonian Fossils. 1876. Corals, pl. 2C, fig. 3, 4.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites hemisphericus** *var.* **turbinatus** Billings

6234 $\frac{3429f}{1}$ HYPOTYPE Favosites turbinatus Billings. Canadian journal. n. s. 1859. 4:109.
Favosites hemisphericus var. turbinatus Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 2C, fig. 5.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6235 $\frac{3429f}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 2, 3.
Onondaga limestone Columbus, O.
R. P. Whitfield, coll. 1865

6236 $\frac{3429f}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 4.
Onondaga limestone Columbus, O.
R. P. Whitfield, coll. 1865

**Favosites placenta** Rominger

6237 $\frac{3429g}{1}$ HYPOTYPE Favosites placenta Rominger. Fossil corals. 1876. p. 34.
Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 3, 10, 11.
Hamilton beds York, Livingston co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

6238 $\frac{3429g}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 4.
Hamilton beds York, N. Y.
C. A. White & C. Van Deloo, coll. 1860

6239 $\frac{3429g}{3}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 5.

Hamilton beds York, N. Y.

6240 $\frac{3429g}{4}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 6–9, 12.

Hamilton beds Western New York

### **Favosites tuberosus** Rominger

6241 $\frac{342\ h}{1}$ **HYPOTYPE** Favosites tuberosus Rominger. Fossil corals. 1876. p. 31.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 8, fig. 2.

Onondaga limestone Cayuga, Ontario, Can.

J. De Cew, coll. 1866

6242 $\frac{3429h}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 7.

Onondaga limestone Ontario, Can.

J. De Cew, coll. 1866

Favosites turbinatus *see* Favosites hemisphericus *var.* turbinatus

### **Favosites ?** sp.

6243 $\frac{3429i}{1}$ **HYPOTYPE** Favosites ? sp. Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 3.

Hamilton beds York, Livingston co. N. Y.

C. Van Deloo, coll. 1865

6244 $\frac{3429i}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 11.

Hamilton beds York, N. Y.

C. Van Deloo, coll. 1865

### **Heliophyllum** Hall

Heliophyllum exiguum *see* Heliophyllum (Zaphrentis) exiguum

### **Heliophyllum (Zaphrentis) exiguum** Billings

6245 $\frac{3442}{1}$ **HYPOTYPE** Heliophyllum exiguum Billings. Canadian journal. n. s. 1860. 5:261.

Heliophyllum (Zaphrentis) exiguum

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 32, fig. 1–3.

Onondaga limestone

Clarence hollow, Erie co. N. Y.

R. P. Whitfield, C. A. White & C. Van Deloo, coll. 1860

**Heliophyllum halli** Milne-Edwards & Haime

6246 $\frac{3443}{1}$ HYPOTYPE Heliophyllum halli Milne-Edwards & Haime. British Fossil corals. 1850. introd. p. 69.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 23 fig. 2.

Hamilton beds West Williams, Ontario, Can.

J. De Cew, coll. 1875

6247 $\frac{3443}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 23, fig. 3.

Hamilton beds Moscow, Livingston co. N. Y.

C. Van Deloo, coll. 1865

Madrepora limbata *see* Striatopora (Thamnoptychia) limbata

MICHELINIA de Koninck

Michelinia convexa *see* Michelinia (Pleurodictyum) convexa

**Michelinia (Pleurodictyum) convexa** d'Orbigny

6248 $\frac{3561}{1}$ HYPOTYPE Michelinia convexa d'Orbigny. Prodrome de Palaeontologie. 1850. 1:107.

Michelinia (Pleurodictyum) convexa Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 2.

Onondaga limestone

6249 $\frac{3561}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 3.

Onondaga limestone Ontario, Can.

J. De Cew, coll. 1866

6250 $\frac{3561}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 4.

Onondaga limestone Cayuga, Ontario, Can.

J. De Cew, coll. 1866

6251 $\frac{3561}{4}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 2.
Onondaga limestone — Western New York
Pickett collection

6252 $\frac{3561}{5}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 9.
Onondaga limestone — Schoharie co. N. Y.
J. Gebhard jr purchase, 1872

6253 $\frac{3561}{6}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 10.
Onondaga limestone

6254 $\frac{3561}{7}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 11.
Onondaga limestone — Falls of the Ohio
R. P. Whitfield, coll. 1865

### **Michelinia (Pleurodictyum) dividua** Hall

6255 $\frac{3562}{1}$ **TYPE** Michelinia (Pleurodictyum) dividua Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 18; pl. 18, fig. 10.
Hamilton beds — York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6256 $\frac{3562}{2}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 18, fig. 11, 12.
Hamilton beds — York, N. Y.
C. Van Deloo, coll. 1865

### **Michelinia (Pleurodictyum) maxima** Troost (sp.)

6257 $\frac{3563}{1}$ **HYPOTYPE** Calamopora maxima Troost. Geological report of Tennessee. 1840. p. 73.
Michelinia (Pleurodictyum) maxima Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 16, fig. 1.
Onondaga limestone

### **Michelinia (Pleurodictyum) stylopora** Eaton (sp.)

6258 $\frac{3564}{1}$ **TYPE** Astrea stylopora Eaton. Geological text book. 1832. p. 40.
Michelinia (Pleurodictyum) sty-

l o p o r a Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 18, fig. 4.

Hamilton beds Skaneateles lake, N. Y.

J. W. Hall & G. B. Simpson, coll. 1872

STRIATOPORA Hall

**Striatopora (Thamnoptychia) limbata** Eaton (sp.)

6259 $\frac{3770}{1}$ HYPOTYPE M a d r e p o r a l i m b a t a Eaton. Geological text book. 1832. p. 39.

S t r i a t o p o r a (T h a m n o p t y c h i a) l i m b a t a Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 33, fig. 13.

Hamilton beds York, Livingston co. N. Y.

C. A. White & C. Van Deloo, coll. 1860

TRACHYPORA Milne-Edwards & Haime

**Trachypora elegantula** Billings

6260 $\frac{3815}{1}$ HYPOTYPE T r a c h y p o r a e l e g a n t u l a Billings. Canadian journal. n. s. 1860. 5: 254.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 33, fig. 3.

Hamilton beds Western New York

ZAPHRENTIS Rafinesque

**Zaphrentis halli** Milne-Edwards & Haime

6261 $\frac{3884}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 2.

Hamilton beds Skaneateles lake, N. Y.

W. M. Gebhard, coll. 1857

6262 $\frac{3884}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 3.

Hamilton beds Skaneateles lake, N. Y.

W. M. Gebhard, coll. 1857

6263 $\frac{3884}{4}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876 Corals, pl. 20, fig. 4.

Hamilton beds Skaneateles lake, N. Y.

J. W. Hall & G. B. Simpson, coll. 1872

6264 $\frac{3884}{5}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 6.

Hamilton beds Skaneateles lake, N Y.
J. W. Hall & G. B. Simpson, coll. 1872

6265 $\frac{3884}{6}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 7.
Hamilton beds Skaneateles lake, N. Y.
W. M. Gebhard, coll. 1857

### Zaphrentis simplex Hall

6266 $\frac{3887}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 21, fig. 5.
Hamilton beds Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6267 $\frac{3887}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. pl. 21, fig. 11.
Hamilton beds Moscow, N. Y.
C. A. White & C. Van Deloo, coll. 1861

## VERMES

### TENTACULITES Schlotheim

### Tentaculites eldredgianus Hartt & Rathbun

6268 $\frac{5289}{1}$ HYPOPLASTOTYPE Tentaculites eldredgianus Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 126.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 29.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### Tentaculites stübeli Clarke

6269 $\frac{5290}{1}$ PLASTOTYPE Tentaculites stübeli Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 43, pl. 4, fig. 24.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6270 $\frac{5290}{2}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 25, 26.
Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6271 $\frac{5290}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 27.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6272 $\frac{5290}{4}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 28.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Tentaculites trombetensis** Clarke

6273 $\frac{5291}{1}$ PLASTOTYPE Tentaculites trombetensis Clarke. Arch. do Mus. Nac. Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 19, pl. 2, fig. 26.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6274 $\frac{5291}{2}$ TYPE Clarke. Arch. do Mus. Nac. Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 27.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

On slab with type of Lingulops derbyi Clarke, pl. 1, fig. 4.

## BRACHIOPODA

ANABAIA Clarke

**Anabaia paraia** Clarke

6275 $\frac{7071}{1}$ TYPE Anabaia paraia Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 12, pl. 2, fig. 2–4.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6276 $\frac{7071}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 5.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6277 $\frac{7071}{3}$ **PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 6
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6278 $\frac{7071}{4}$ **PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 7.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6279 $\frac{7071}{5}$ **TYPE: PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 8.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6280 $\frac{7071}{6}$ **TYPE: PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 9.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### CHONETES Fischer

### **Chonetes** *cf.* **nova-scotica** Hall

6281 $\frac{7257}{1}$ **HYPOTYPE** Chonetes nova-scotica Hall. Canadian naturalist and geologist. 1860. 5: 144.
Chonetes cf. nova-scotica Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 25.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### LINGULA Bruguiere

Lingula cuneata *see* Lingula *cf.* oblata

### **Lingula** *cf.* **oblata** Hall

6282 $\frac{7693}{1}$ **HYPOTYPE** Lingula oblata Hall. Geology of New York; report on the 4th District. 1843. p. 77.
Lingula cuneata Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2: 92.

Lingula cuneata Derby. Proceedings of the American philosophical society. 1879. 18: 168.

Lingula cf. oblata Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 4, pl. 1, fig. 3.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

LINGULOPS Hall

**Lingulops derbyi** Clarke

6283 $\frac{7723}{1}$ TYPE: PLASTOTYPE Lingulops derbyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 5, pl. 1, fig. 4.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

On slab with type of Tentaculites trombetensis Clarke, pl. 2, fig. 27.

ORBICULOIDEA d'Orbigny

**Orbiculoidea hartti** Clarke

6284 $\frac{7897}{1}$ TYPE Orbiculoidea hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 7, pl. 1, fig. 5, 6.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

ORTHIS Dalman

**Orthis callactis** Dalman *var.* **amazonica** Clarke

6285 $\frac{7924}{1}$ TYPE Orthis callactis var. amazonica Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 9, pl. 1, fig. 17.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6286 $\frac{7924}{2}$ TYPE: PLASTOTYPE Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 18, 19.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6287 $\frac{7924}{3}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 20.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6288 $\frac{7924}{4}$ TYPE: PLASTOTYPE Clarke. Arch do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 21.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### **Orthis freitana** Clarke

6289 $\frac{7925}{1}$ TYPE Orthis freitana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 10, pl. 1, fig. 22.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6290 $\frac{7925}{2}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 23, 24.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### **Orthis smithi** Clarke

6291 $\frac{7926}{1}$ TYPE Orthis smithi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 11, pl. 1, fig. 12.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6292 $\frac{7926}{2}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 13, 14.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6293 $\frac{7926}{3}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 15.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6294 $\frac{7926}{4}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 16.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PHOLIDOPS Hall

**Pholidops trombetana** Clarke

6295 $\frac{8019}{1}$ TYPE Pholidops trombetana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 8, pl. 1, fig. 11.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6296 $\frac{8019}{2}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 7–9.
Siluric — Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## LAMELLIBRANCHIATA

ACTINOPTERIA Hall

**Actinopteria eschwegii** Clarke

6297 $\frac{9021}{1}$ TYPE Actinopteria eschwegii Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 45, pl. 5, fig. 1.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6298 $\frac{9021}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6299 $\frac{9021}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 4.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6300 $\frac{9021}{4}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 6.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby &. J M. Clarke, donors

6301 $\frac{9021}{5}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Actinopteria humboldti** Clarke

6302 $\frac{9022}{1}$ TYPE Actinopteria humboldti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 47, pl. 5, fig. 3.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6303 $\frac{9022}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 7.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6304 $\frac{9022}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 11.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6305 $\frac{9022}{4}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 12.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

ANODONTOPSIS McCoy

**Anodontopsis austrina** Clarke

6306 $\frac{9043}{1}$ TYPE Anodontopsis austrina Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 16, pl. 2, fig. 12.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Anodontopsis putilla** Clarke

6307 $\frac{9044}{1}$ TYPE Anodontopsis putilla Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 16, pl. 2, fig. 10, 11.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CIMITARIA Hall

**Cimitaria** sp. Clarke

6308 $\frac{9104}{1}$ HYPOTYPE Cimitaria sp. Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 62, pl. 7, fig. 14.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Cimitaria karsteni** Clarke

6309 $\frac{9105}{1}$ TYPE Cimitaria karsteni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 60, pl. 8, fig. 18.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6310 $\frac{9105}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 19.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CLIDOPHORUS Hall

**Clidophorus brasilianus** Clarke

6311 $\frac{9111}{1}$ TYPE Clidophorus brasilianus Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 18, pl. 2, fig. 17, 18.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6312 $\frac{9111}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 19.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CYPRICARDELLA Hall

**Cypricardella hartti** Clarke

6313 $\frac{9155}{1}$ TYPE Cypricardella hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 63, pl. 7, fig. 1.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6314 $\frac{9155}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6315 $\frac{9155}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 3.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Cypricardella pohli** Clarke

6316 $\frac{9156}{1}$ TYPE Cypricardella pohli Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 64, pl. 6, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

EDMONDIA de Koninck

Edmondia pondiana *see* Palaeoneilo pondiana

**Edmondia sylvana** Hartt & Rathbun

6317 $\frac{9196}{1}$ HYPOTYPE Edmondia sylvana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 122.

Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 12.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

GONIOPHORA Phillips

**Goniophora woodwardi** Clarke

6318 $\frac{9261}{1}$ TYPE Goniophora woodwardi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 53, pl. 6, fig. 3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

GRAMMYSIA de Verneuil

**Grammysia burmeisteri** Clarke

6319 $\frac{9283a}{1}$ TYPE Grammysia burmeisteri Clarke. Arch. do. Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 65, pl. 7, fig. 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia gardneri** Clarke

6320 $\frac{9290a}{1}$ TYPE Grammysia gardneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 67, pl. 7, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia lundi** Clarke.

6321 $\frac{9291a}{1}$ TYPE Grammysia lundi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1889. v. 10. Author's Eng. ed. 1900. p. 66, pl. 6, fig. 11, 12.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6322 $\frac{9291a}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1889. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 13.
Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia pissisi** Clarke

6323 $\frac{9295a}{1}$ TYPE Grammysia pissisi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 65, pl. 7, fig. 7.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6324 $\frac{9295a}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 8.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia ulrichi** Clarke

6325 $\frac{9298a}{1}$ TYPE Grammysia ulrichi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 67, pl. 7, fig. 12.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Guerangeria** Oehlert or **Nyassa** Hall

**Guerangeria** (or **Nyassa**) **ortoni** Clarke

6326 $\frac{9299a}{1}$ TYPE Guerangeria (or Nyassa) ortoni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 62, pl. 7, fig. 6.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke donors

LIOPTERIA Hall

**Liopteria browni** Clarke

6327 $\frac{9383}{1}$ TYPE Liopteria browni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 48, pl. 5, fig. 13.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

MODIOMORPHA Hall

**Modiomorpha helmreicheni** Clarke

6328 $\frac{9532}{1}$ TYPE Modiomorpha helmreicheni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 50, pl. 6, fig. 1.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6329 $\frac{9532}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6330 $\frac{9532}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 17.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Modiomorpha pimentana** Hartt & Rathbun

6331 $\frac{9533}{1}$ HYPOTYPE Modiomorpha pimentana Hartt & Rathbun. Annals of New York lyceum of natural history. 1875. 11:123
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 4.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Modiomorpha sellowi** Clarke

6332 $\frac{9534}{1}$ TYPE Modiomorpha sellowi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 51, pl. 6, fig. 14.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6333 $\frac{9534}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 16.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6334 $\frac{9534}{3}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 15.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### NUCULA Lamarck

**Nucula bellistriata** Conrad *var.* **parvula** Clarke

6335 $\frac{9570a}{1}$ **TYPE** Nucula bellistriata var. parvula Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 70, pl. 8, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### NUCULITES Conrad

**Nuculites branneri** Clarke

6336 $\frac{9586}{1}$ **TYPE** Nuculites branneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 73, pl. 8, fig. 6.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6337 $\frac{9586}{2}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 7.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6338 $\frac{9586}{3}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 8.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Nuculites ererensis** Hartt & Rathbun

6339 $\frac{9587}{1}$ **HYPOTYPE** Nuculites ererensis Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 120.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6340 $\frac{9587}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 4.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### **Nuculites smithi** Clarke

6341 $\frac{9588}{1}$ TYPE Nuculites smithi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 71, pl. 8, fig. 5.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### PALAEONEILO Hall

### **Palaeoneilo orbignyi** Clarke

6342 $\frac{9649b}{1}$ TYPE Palaeoneilo orbignyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 74, pl. 8, fig. 14.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6343 $\frac{9649b}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 15.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6344 $\frac{9649b}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 16.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6345 $\frac{9649b}{4}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 17.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Palaeoneilo pondiana** Hartt & Rathbun (sp.)

6346 $\frac{9649c}{1}$ HYPOTYPE Edmondia pondiana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 121.

Palaeoneilo pondiana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 76, pl. 7, fig. 4.

Devonic (Ereré group) Ereré, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Palaeoneilo sulcata** Hartt & Rathbun

6347 $\frac{9649d}{1}$ HYPOTYPE Palaeoneilo sulcata Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 124.

Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 13.

Devonic (Ereré group) Ereré, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

SPHENOTUS Hall

**Sphenotus bodenbenderi** Clarke

6348 $\frac{9868}{1}$ TYPE Sphenotus bodenbenderi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 58, pl. 5, fig. 17.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6349 $\frac{9868}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 25.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6350 $\frac{9868}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 26.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Sphenotus gorceixi** Clarke

6351 $\frac{9869}{1}$ TYPE Sphenotus gorceixi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 59, pl. 5, fig. 14.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6352 $\frac{9869}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 16.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

TELLINOMYA Hall

**Tellinomya pulchella** Clarke

6353 $\frac{9906}{1}$ TYPE Tellinomya pulchella Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 17, pl. 2, fig. 13.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6354 $\frac{9906}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 14.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6355 $\frac{9906}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 15.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J M. Clarke, donors

TOECHOMYA Clarke

**Toechomya freitasi** Clarke

6356 $\frac{9950}{1}$ TYPE Toechomya freitasi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 58, pl. 8, fig. 21.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J M. Clarke, donors

6357 $\frac{9950}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 22.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Toechomya rathbuni** Clarke

6358 $\frac{9951}{1}$ TYPE Toechomya rathbuni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 57, pl. 8, fig. 23.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6359 $\frac{9951}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 24.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## GASTROPODA

### BELLEROPHON Montfort

**Bellerophon morganianus** Hartt & Rathbun

6360 $\frac{10020}{1}$ HYPOTYPE Bellerophon morganianus Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11:117
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 3, fig. 1–3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Bellerophon steltzneri** Clarke

6361 $\frac{10021}{1}$ PLASTOTYPE Bellerophon steltzneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 34, pl. 3, fig. 5, 6.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### BUCANIA Hall

**Bucania freitasi** Clarke

6362 $\frac{10032a}{1}$ TYPE Bucania freitasi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 35, pl. 3, fig. 22.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

Bucania trilobita *see* Bucaniella trilobita *var.* vira-mundo

BUCANIELLA Meek

**Bucaniella reissi** Clarke

6363 $\frac{10032aa}{1}$ TYPE Bucaniella reissi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 37, pl. 3, fig. 7–9.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Bucaniella trilobita** Conrad *var.* **vira-mundo** Clarke

6364 $\frac{10032ab}{1}$ TYPE Bucania trilobita Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2: 92.

Bucania trilobita Derby. Proc. Amer. Phil. Soc. 1879. 28: 168.

Bucaniella trilobita var. vira-mundo. Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 18, pl. 2, fig. 20–22.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

DIAPHOROSTOMA Fischer

**Diaphorostoma ? agassizi** Clarke

6365 $\frac{10117}{1}$ TYPE: PLASTOTYPE Diaphorostoma ? agassizi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 20, 21.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Diaphorostoma darwini** Clarke

6366 $\frac{10118}{1}$ TYPE Diaphorostoma darwini Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 18.

Devonic (Maecurú group) Rio Curuá, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Diaphorostoma furmanianum** Hartt & Rathbun (sp.)

6367 $\frac{10119}{1}$ HYPOPLASTOTYPE Holopea furmanianum Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 115.

Diaphorostoma furmanianum Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 10.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

Holopea furmanianum *see* Diaphorostoma furmanianum

PLATYCERAS Conrad

**Platyceras hartti** Clarke

6368 $\frac{10329}{1}$ TYPE Platyceras hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 30, pl. 4, fig. 22, 23.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Platyceras hussaki** Clarke

6369 $\frac{10330}{1}$ TYPE Platyceras hussaki Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 29, pl. 4, fig. 6.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6370 $\frac{10330}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 7.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Platyceras steinmanni** Clarke

6371 $\frac{10331}{1}$ TYPE Platyceras steinmanni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 30, pl. 4, fig. 8, 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras symmetricum** Hall *var.* **maecuruense** Clarke

6372 $\frac{10332}{1}$ TYPE Platyceras symmetricum var. maecuruense Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 31, pl. 4, fig. 1, 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras whitii** Clarke

6373 $\frac{10333}{1}$ TYPE Platyceras whitii Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 28, pl. 4, fig. 3, 4.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras whitii** Clarke *var.* **curua** Clarke

6374 $\frac{10334}{1}$ TYPE Platyceras whitii var. curuá Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 29, pl. 4. fig. 5.
Devonic (Maecurú group)
Rio Curuá, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PLECTONOTUS Clarke

**Plectonotus derbyi** Clarke

6375 $\frac{10335}{1}$ TYPE Plectonotus derbyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 38, pl. 3, fig. 14–16.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6376 $\frac{10335}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 3, fig. 17, 18.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Plectonotus ? salteri** Clarke

6377 $\frac{10336}{1}$ TYPE Plectonotus ? salteri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 38, pl. 3 fig. 12, 13.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PLEUROTOMARIA Defrance

**Pleurotomaria rochana** Hartt & Rathbun

6378 $\frac{10409}{1}$ HYPOPLASTOTYPE Pleurotomaria rochana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 114.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 17.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PTOMATIS Clarke

**Ptomatis forbesi** Clarke

6379 $\frac{10437}{1}$ TYPE: PLASTOTYPE Ptomatis forbesi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 42, pl. 3, fig. 23–25.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## PTEROPODA

CONULARIA Miller

**Conularia amazonica** Clarke

6380 $\frac{11011}{1}$ TYPE (original & counterpart): PLASTOTYPE Conularia amazonica Clarke. Arch. do Mus. Nac. do

Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 20, pl. 2, fig. 23, 25.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6381 $\frac{11011}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 24.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

## CEPHALOPODA

### BALTOCERAS Holm

**Baltoceras (?) pusillum** Ruedemann

6382 $\frac{12035}{1}$ TYPE Baltoceras (?) pusillum Ruedemann. New York state museum bulletin 90. 1906. p. 431, pl. 9, fig. 4, 5.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

### BARRANDEOCERAS Hyatt

**Barrandeoceras natator** Billings (sp.)

6383 $\frac{12050}{1}$ HYPOTYPE Nautilus natator Billings. Canadian naturalist. 1859. v. 4, no. 6, p. 466. Barrandeoceras natator Ruedemann. New York state museum bulletin 90. 1906. pl. 32, 33.

Upper Chazy limestone Valcour island, N. Y.

R. Ruedemann, coll. 1904

### CAMEROCERAS Conrad

**Cameroceras (Proterocameroceras) brainerdi** Whitfield (sp.)

6384 $\frac{12084}{13}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 5, 6.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6385 $\frac{12084}{14}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 1.

Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Cameroceras tenuiseptum** Hall (sp.)

6386 $\frac{12085}{1}$ HYPOTYPE Orthoceras tenuiseptum Hall. Paleontology of New York. 1847. 1:35.
Cameroceras tenuiseptum Ruedemann. New York state museum bulletin 90. 1906. pl. 3, fig. 2.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6387 $\frac{12085}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 6, fig. 2.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
R. Ruedemann, coll. 1903

CYRTACTINOCERAS Hyatt

**Cyrtactinoceras boycii** Whitfield (sp.)

6388 $\frac{12095}{1}$ HYPOTYPE Cyrtoceras boycii Whitfield. American museum of natural history bulletin 8. 1886. p. 326.
Cyrtactinoceras boycii Ruedemann. New York state museum bulletin 90. 1906. p. 490, fig. 45.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

6389 $\frac{12095}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 35, fig. 2.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6390 $\frac{12095}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 35, fig. 3, 4.
Middle Chazy Chazy, N. Y.
R. Ruedemann, coll. 1903

**Cyrtactinoceras champlainense** Ruedemann

6391 $\frac{12096}{1}$ TYPE Cyrtactinoceras champlainense Ruedemann. New York state museum bulletin 90. 1906. p. 491; p. 491, fig. 48, 49; pl. 34, fig. 3.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6392 $\frac{12096}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 491, fig. 50; pl. 36, fig. 1, 2.
Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

### CYRTENDOCERAS Remélé

**Cyrtendoceras (?) priscum** Ruedemann

6393 $\frac{12098}{1}$ TYPE Cyrtendoceras (?) priscum Ruedemann. New York state museum bulletin 90. 1906. p. 430, pl. 2, fig. 2.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6394 $\frac{12098}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 3.
Beekmantown beds Beekmantown, N.Y.
R. Ruedemann, coll. 1903

6395 $\frac{12098}{3}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 4.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6396 $\frac{12098}{4}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 5.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

### CYRTOCERAS Goldfuss

Cyrtoceras boycii *see* Cyrtactinoceras boycii

Cyrtoceras metula *see* Cyrtoceras (Gomphoceras) metula

**Cyrtoceras (Gomphoceras) metula** Hall

6397 $\frac{12108}{2}$ TYPE Hall. 15th Annual report of the New York state cabinet of natural history. 1862. pl. 9, fig. 7.
Hall. Illustrations of Devonian fossils. 1876. Cephalopoda. pl. 46, fig. 1, 2.

Hall. Paleontology of New York. 1879. v. 5, pt 2, pl. 47, fig. 1, 2.

Onondaga limestone Clarence Hollow, N Y.

**(Cyrtoceras) confertissimum** Whitfield

6398 $\frac{12112}{1}$ HYPOTYPE Cyrtoceras confertissimum Whitfield. American museum of natural history bulletin 8. 1886. p. 327.

Ruedemann. New York state museum bulletin 90. 1906. pl. 38, fig. 1–4.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

DELTOCERAS Hyatt

**Deltoceras vaningeni** Ruedemann

6399 $\frac{12131}{1}$ TYPE Deltoceras vaningeni. Ruedemann. New York state museum bulletin 90. 1906. p. 480; p. 481, fig. 39; pl 25, 26.

Lower Chazy limestone Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6400 $\frac{12131}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 481, fig. 40; pl. 27.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6401 $\frac{12131}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 481, fig. 41; pl. 28.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

ENDOCERAS Hall

**Endoceras (?) champlainense** Ruedemann

6402 $\frac{12132}{1}$ TYPE: PLASTOTYPE Endoceras (?) champlainense Ruedemann. New York state museum bulletin 90. 1906. p. 418; p. 419, fig. 5.

Beekmantown beds

Beekmantown, Clinton co. N. Y.

R. Ruedemann, coll. 1903

6403 $\frac{12132}{2}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 1.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6404 $\frac{12132}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 2.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6405 $\frac{12132}{4}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 3.
Beekmantown beds Beekmantown, N. Y.

6406 $\frac{12132}{5}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 4.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

**Endoceras hudsoni** Ruedemann

6407 $\frac{12133}{1}$ TYPE Endoceras hudsoni Ruedemann. New York state museum bulletin 90. 1906. p. 421; p. 422, fig. 6; pl. 7.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

**Endoceras magister** Ruedemann

6408 $\frac{12134}{1}$ TYPE Endoceras magister Ruedemann. New York state museum bulletin 90. 1906. p. 423; p. 423, fig. 7; pl. 8.
Lower Chazy limestone
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

EURYSTOMITES Schröder

**Eurystomites accelerans** Ruedemann

6409 $\frac{12150}{1}$ TYPE Eurystomites accelerans Ruedemann. New York state museum bulletin 90. 1906. p. 460; p. 460, fig. 23; pl. 18, fig. 2, 3.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Eurystomites amplectens** Ruedemann

6410 $\frac{12151}{1}$ TYPE Eurystomites amplectens Ruedemann. New York state museum bulletin 90. 1906. p. 461; p. 461, fig. 24; pl. 18, fig. 4–7.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

**Eurystomites kelloggi** Whitfield (sp.)

6411 $\frac{12152}{1}$ HYPOTYPE Nautilus kelloggi Whitfield. American museum of natural history bulletin 8. 1836. p. 328.

Eurystomites kelloggi Ruedemann. New York state museum bulletin 90. 1906. p. 456, fig. 21.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6412 $\frac{12152}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 458, fig. 22.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6413 $\frac{12152}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 17.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6414 $\frac{12152}{4}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 18, fig. 1.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

GEISONOCERAS Hyatt

**Geisonoceras shumardi** Billings (sp.)

6415 $\frac{12155}{1}$ HYPOTYPE Orthoceras shumardi Billings. Canadian naturalist and geologist. 1859. 4: 460.

Geisonoceras shumardi Ruedemann New York state museum bulletin 90. 1906. pl. 12, fig 4.

Middle Chazy limestone Chazy, Clinton co. N. Y.

R. Ruedemann, coll. 1903

GONIOCERAS Hall

**Gonioceras chaziense** Ruedemann

6416 $\frac{12210}{1}$ TYPE G o n i c e r a s c h a z i e n s e Ruedemann. New York state museum bulletin 90. 1906. p. 494, pl. 36, fig. 3.
Middle Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6417 $\frac{12210}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 36, fig. 4.
Middle Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

L i t u i t e s e a t o n i *see* Schroederoceras eatoni

L i t u i t e s e a t o n i *var.* c a s s i n e n s i s *see* Schroederoceras cassinense

L i t u i t e s s e e l y i *see* Tarphyceras seelyi

LOXOCERAS McCoy

**Loxoceras moniliforme** Hall (sp.)

6418 $\frac{12270}{1}$ HYPOTYPE O r t h o c e r a s m o n i l i f o r m e Hall. Paleontology of New York. 1847. 1: 35.
L o x o c e r a s m o n i l i f o r m e Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 7.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6419 $\frac{12270}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 8.
Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6420 $\frac{12270}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 9.
Middle Chazy limestone
Saranac river, Plattsburg, N. Y.
G. van Ingen, coll. 1901

NANNO Clarke

**Nanno noveboracum** Ruedemann

6421 $\frac{12317}{1}$ TYPE N a n n o n o v e b o r a c u m Ruedemann. New York state museum bulletin 90. 1906. p. 427, pl. 9. fig. 6, 7.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

Nautilus jason *see* Plectoceras jason

Nautilus kelloggi *see* Eurystomites kelloggi

Nautilus natator *see* Barrandeoceras natator

### ONCOCERAS Hall

**Oncoceras pristinum** Ruedemann

6422 $\frac{12336}{1}$ TYPE Oncoceras pristinum Ruedemann. New York state museum bulletin 90. 1906. p. 503, pl. 34, fig. 1.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6423 $\frac{12336}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 2.

Upper Chazy limestone Chazy, N. Y.

### OOCERAS Hyatt

**Ooceras (?) lativentrum** Ruedemann

6424 $\frac{12338}{1}$ TYPE Ooceras (?) lativentrum. Ruedemann. New York state museum bulletin 90. 1906. p. 497; p. 498, fig. 52.

Lower Chazy limestone Chazy, Clinton co. N. Y.
G. van Ingen, coll. 1902

### ORTHOCERAS Breynius

**Orthoceras** sp.

6425 $\frac{12428}{1}$ HYPOTYPE Orthoceras sp. Clarke. Arch. do Mus. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 28, 29.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

Orthoceras clintoni *see* Spyroceras clintoni

Orthoceras cornu-oryx *see* Orygoceras cornu-oryx

Orthoceras furtivum *see* Protocycloceras ? *cf.* furtivum

Orthoceras lamarcki *see* Protocycloceras lamarcki

**Orthoceras lentum** Ruedemann

6426 $\frac{12429}{1}$ TYPE Orthoceras lentum Ruedemann. New York state museum bulletin 90. 1906. p. 433; p. 433, fig. 12; pl. 14, fig. 1, 2, 3.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

Orthoceras moniliforme *see* Loxoceras moniliforme

**Orthoceras modestum** Ruedemann

6427 $\frac{12430}{1}$ TYPE Orthoceras modestum Ruedemann. New York state museum bulletin 90. 1906. p. 436; p. 436, fig. 14.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6428 $\frac{12430}{2}$ TYPE Ruedemann. New York state musuem bulletin 90. 1906. pl. 12, fig. 1.

Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6429 $\frac{12430}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 12, fig. 2.

Upper Chazy limestone Chazy, N. Y.
G. H. Hudson, donor

6430 $\frac{12430}{4}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 12, fig. 3.

Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

**Orthoceras progressum** Ruedemann

6431 $\frac{12431}{1}$ TYPE Orthoceras progressum Ruedemann. New York state museum bulletin 90. 1906. p. 434; p. 434, fig. 13; pl. 12, fig. 5, 6.

Upper Chazy limestone

Valcour island, Clinton co. N. Y.

G. H. Hudson, donor

Orthoceras schumardi *see* Geisonoceras shumardi

Orthoceras tenuiseptum *see* Cameroceras tenuiseptum

Orthoceras subarcuatum *see* Spyroceras clintoni

**Orthoceras (?) vagum** Ruedemann

6432 $\frac{12432}{1}$ TYPE Orthoceras (?) vagum Ruedemann. New York state museum bulletin 90. 1906. p. 435, pl. 9, fig. 9; pl. 13, fig. 1, 2.

Upper Chazy limestone Valcour island, N. Y.

G. H. Hudson, donor

ORYGOCERAS Ruedemann

**Orygoceras cornu-oryx** Whitfield (sp.)

6433 $\frac{12438}{1}$ HYPOTYPE Orthoceras cornu-oryx Whitfield. American museum of natural history bulletin 8. 1886. p. 320.

Orygoceras cornu-oryx Ruedemann. New York state museum bulletin 90. 1906. pl. 14, fig. 6.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

PILOCERAS Salter

**Piloceras explanator** Whitfield (sp.)

6434 $\frac{12460}{5}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 10, 11.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

PLECTOCERAS Hyatt

**Plectoceras jason** Billings (sp.)

6435 $\frac{12465}{1}$ HYPOTYPE Nautilus jason Billings. Canadian naturalist and geologist. 1859. 4: 464.

Plectoceras jason Ruedemann. New York state museum bulletin 90. 1906. p. 485, fig. 44.

Lower Chazy limestone

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6436 $\frac{12465}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 484, fig. 43; pl. 24, fig. 1.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6437 $\frac{12465}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 30.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6438 $\frac{12465}{4}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 484, fig. 42; pl. 29, 31.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

PROTOCYCLOCERAS Hyatt

**Protocycloceras ?** *cf.* **furtivum** Billings (sp.)

6439 $\frac{12466}{1}$ HYPOTYPE: HYPOPLASTOTYPE Orthoceras furtivum Billings. Geology of Canada; Paleozoic fossils. 1865. 1: 337.

Protocycloceras ? cf. furtivum Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 3.

Beekmantown beds

Beekmantown, Clinton co. N. Y.

R. Ruedemann coll. 1903

**Protocycloceras lamarcki** Billings (sp.)

6440 $\frac{12467}{1}$ HYPOTYPE Orthoceras lamarcki Billings. Canadian naturalist and geologist. 1859. 4: 362.

Protocycloceras lamarcki Ruedemann. New York state museum bulletin 90. 1906. p. 442, fig. 15.

Beekmantown limestone (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6441 $\frac{12467}{2}$ **HYPOTYPE: HYPOPLASTOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 1.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6442 $\frac{12467}{3}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. p. 443, fig. 16; pl. 15, fig. 2, 3.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6443 $\frac{12467}{4}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 4.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6444 $\frac{12467}{5}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 5.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6445 $\frac{12467}{6}$ **HYPOTYPE: HYPOPLASTOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 6.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6446 $\frac{12467}{7}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 1, 2.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

### SCHROEDEROCERAS Hyatt

**Schroederoceras cassinense** Whitfield (sp.)

6447 $\frac{12510}{1}$ **HYPOTYPE** *Lituites eatoni* var. *cassinensis* Whitfield. American museum of natural history bulletin 8. 1886. p. 332.

*Schroederoceras cassinense* Ruedemann. New York state museum bulletin 90. 1906. p. 477, fig. 36.

Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6448 $\frac{12510}{2}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 1, 2.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Schroederoceras eatoni** Whitfield (sp.)

6449 $\frac{12511}{1}$ **HYPOTYPE** Lituites eatoni Whitfield. American museum of natural history bulletin 8. 1886. p. 331.
Schroederoceras eatoni Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 3.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6450 $\frac{12511}{2}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 4.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

SPYROCERAS Hyatt

**Spyroceras clintoni** Miller (sp.)

6451 $\frac{12515}{1}$ **HYPOTYPE** Orthoceras subarcuatum Hall. Paleontology of New York. 1847. 1: 34.
Orthoceras clintoni Miller. American Paleozoic Fossils. 1877. p. 244.
Spyroceras clintoni Ruedemann. New York state museum bulletin 90. 1906. p. 447, fig. 18.
Lower Chazy limestone Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6452 $\frac{12515}{2}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 4.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6453 $\frac{12515}{3}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906 pl. 16, fig. 5.

Middle Chazy limestone

Valcour island, Clinton co. N. Y.

R. Ruedemann, coll. 1903

6454 $\frac{12515}{4}$ HYPOTYPE. Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 6.

Upper Chazy limestone Chazy, N. Y.

R. Ruedemann, coll. 1903

6455 $\frac{12515}{5}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 7.

Upper Chazy limestone

Little Monty bay, Lake Champlain, N. Y.

TARPHYCERAS Hyatt

**Tarphyceras seelyi** Whitfield (sp.)

6456 $\frac{12517}{1}$ HYPOTYPE Lituites seelyi Whitfield. American museum of natural history bulletin 8. 1886. p. 330.

Tarphyceras seelyi Ruedemann. New York state museum bulletin 90. 1906. p. 466, fig. 25.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6457 $\frac{12517}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 467, fig. 26.

Beekmantown (Fort Cassin beds) Valcour, N. Y

G. van Ingen & R. Ruedemann, coll. 1899

6458 $\frac{12517}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 19, fig. 1; pl. 24, fig. 3.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6459 $\frac{12517}{4}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 19, fig. 2.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6460 $\frac{12517}{5}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 5.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6461 $\frac{12517}{6}$ **HYPOTYPE** New York state museum bulletin 90. 1906 pl. 21.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Tarphyceras clarkei** Ruedemann

6462 $\frac{12518}{1}$ **TYPE** Tarphyceras clarkei Ruedemann. New York state museum bulletin 90. 1906. p. 470; p. 471, fig. 27–31, pl. 22.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

VAGINOCERAS Hyatt

**Vaginoceras oppletum** Ruedemann

6463 $\frac{12601}{1}$ **TYPE** Vaginoceras oppletum Ruedemann. New York state museum bulletin 90. 1906. p. 413, pl. 4, fig. 2, 3.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6464 $\frac{12601}{2}$ **TYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 5, fig. 1
Lower Chazy limestone
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6465 $\frac{12601}{3}$ **TYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 5, fig. 2–4.
Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6466 $\frac{12601}{4}$ **TYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 6, fig. 1.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

6467 $\frac{12601}{5}$ **TYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 9, fig. 1.
Upper Chazy limestone Valcour island, N. Y.
G. H. Hudson, donor

6468 $\frac{12601}{6}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 9, fig. 2, 3.
Upper Chazy limestone Valcour island, N. Y.
G. H. Hudson, donor

## CRUSTACEA

### BOLLIA Jones & Holl

**Bollia lata** Vanuxem (Conrad) *var.* **brasiliensis** Clarke

6469 $\frac{13102}{1}$ TYPE Bollia lata var. brasiliensis Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 22; pl. 2, fig. 30, 31.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors
Cypridina minuta *see* Primitia minuta

### LEPIDOCOLEUS Faber

**Lepidocoleus polypetalus** Clarke

6470 $\frac{13681}{1}$ TYPE Lepidocoleus polypetalus Clarke. American Geologist. 1896. 17: 142, pl. 17, fig. 7, 8.
Helderbergian Albany co. N. Y.
J. M. Clarke, donor

### PEPHRICARIS Clarke

**Pephricaris horripilata** Clarke

6471 $\frac{13860}{2}$ TYPE Clarke. 15th annual report of the New York state geologist. 1898. 1: 732, fig. 2.
Chemung beds Alfred, N. Y.
J. M. Clarke, donor

### PRIMITIA Jones

**Primitia minuta** Eichwald

6472 $\frac{13942}{1}$ HYPOTYPE Cypridina minuta Eichwald. 1854. v. 27, pt 1, p. 99.
Primitia minuta Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 32.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

# CLASSIFICATION OF TYPE SPECIMENS BY GEOLOGIC FORMATIONS

**References are to the serial marginal numbers at the left of each page.**

## LOWER SILURIC

### BEEKMANTOWN LIMESTONE

**Cephalopoda**

Baltoceras (?) pusillum, 6382
Cameroceras (Proterocameroceras) brainerdi, 6384, 6385
Cyrtendoceras (?) priscum, 6393–6396
(Cyrtoceras) confertissimum, 6398
Endoceras (?) champlainense, 6402–6406
Eurystomites accelerans, 6409
Eurystomites amplectens, 6410
Eurystomites kelloggi, 6411–6414
Orygoceras cornu-oryx, 6433
Piloceras explanator, 6434
Protocycloceras (?) *cf.* furtivum, 6439
Protocycloceras lamarcki, 6440–6446
Schroederoceras cassinense, 6447, 6448
Schroederoceras eatoni, 6449, 6450
Tarphyceras seelyi, 6456–6461
Tarphyceras clarkei, 6462

### LOWER CHAZY LIMESTONE

**Cephalopoda**

Deltoceras vaningeni, 6399–6401
Endoceras magister, 6408
Ooceras (?) lativentrum, 6424
Plectoceras jason, 6435–6438
Spyroceras clintoni, 6451
Vaginoceras oppletum, 6464

### MIDDLE CHAZY LIMESTONE

**Cephalopoda**

Cyrtactinoceras boycii, 6389
Geisonoceras shumardi, 6415
Geisonoceras chaziense, 6416, 6417
Loxoceras moniliforme, 6420?
Spyroceras clintoni, 6453

### UPPER CHAZY LIMESTONE

**Cephalopoda**

Barrandeoceras natator, 6383
Cameroceras tenuiseptum, 6386, 6387
Cyrtactinoceras boycii, 6388–6390
Cyrtactinoceras champlainense, 6391, 6392
Endoceras hudsoni, 6407
Loxoceras moniliforme, 6418, 6419
Nanno noveboracum, 6421
Oncoceras pristinum, 6422, 6423
Orthoceras lentum, 6426
Orthoceras modestum, 6427–6430
Orthoceras progressum, 6431
Orthoceras (?) vagum, 6432
Spyroceras clintoni, 6452, 6454, 6455
Vaginoceras oppletum, 6463, 6465–6468

# SILURIC

### Plantae

Arthrophycus harlani, 6176

### Spongiae

Hexactinellid sponge, 6177, 6178

### Vermes

Tentaculites trombetensis, 6273, 6274

### Brachiopoda

Anabaia paraia, 6275–6280
Chonetes *cf.* nova-scotica, 6281
Lingula *cf.* oblata, 6282
Lingulops derbyi, 6283
Orbiculoidea hartti, 6284
Orthis callactis *var.* amazonica, 6285–6288
Orthis freitana, 6289, 6290
Orthis smithi, 6291–6294
Pholidops trombetana, 6295, 6296

### Lamellibranchiata

Anodontopsis austrina, 6306
Anodontopsis putilla, 6307
Clidophorus brasilianus, 6311, 6312
Tellinomya pulchella, 6353–6355

### Gastropoda

Bucaniella trilobita *var.* vira-mundo 6364

### Pteropoda

Conularia amazonica, 6380, 6381

### Cephalopoda

Orthoceras sp. 6425

### Crustacea

Bollia lata *var.* brasiliensis, 6469
Primitia minuta, 6472

# LOWER DEVONIC

## HELDERBERGIAN

### Crustacea

Lepidocoleus polypetalus, 6470

# MIDDLE DEVONIC

## ONONDAGA LIMESTONE

### Cnidaria

Chaetetes humilis, 6188–6190
Chaetetes tenuis, 6191
Favosites emmonsi, 6209–6216
Favosites epidermatus, 6217–6219
Favosites epidermatus *var.* corticosus, 6220, 6221
Favosites hemisphericus, 6228
Favosites hemisphericus *var.* a, 6229, 6230
Favosites hemisphericus *var.* distortus, 6231
Favosites hemisphericus *var.* rectus, 6232, 6233
Favosites hemisphericus *var.* turbinatus 6234–6236
Favosites tuberosus, 6241, 6242
Heliophyllum (Zaphrentis) exiguum, 6245
Michelinia (Pleurodictyum) convexa, 6248–6254
Michelinia (Pleurodictyum) maxima, 6257

### Cephalopoda

Cyrtoceras (Gomphoceras) metula, 6397

## HAMILTON BEDS

**Cnidaria**

Alveolites goldfussi, 6179, 6180
Chaetetes fruiticosus, 6181–6183
Chaetetes furcatus, 6184–6187
Cystiphyllum americanum, 6192, 6193
Cystiphyllum conifollis, 6194
Cystiphyllum varians, 6195, 6196
Favosites arbuscula, 6197–6208
Favosites (Michelinia) explanatus, 6222
Favosites hamiltonensis, 6223–6227
Favosites placenta, 6237–6240
Favosites ? sp. 6243, 6244
Heliophyllum halli, 6246, 6247
Michelinia (Pleurodictyum) dividua, 6255, 6256
Michelinia (Pleurodictyum) stylopora, 6258
Striatopora (Thamnoptychia) limbata, 6259
Trachypora elegantula, 6260
Zaphrentis halli, 6261–6265
Zaphrentis simplex, 6265, 6267

# UPPER DEVONIC

## CHEMUNG BEDS

**Crustacea**

Pephricaris horripilata, 6471

# DEVONIC

## MAECURU GROUP

**Vermes**

Tentaculites stubeli, 6269–6272

**Lamellibranchiata**

Actinopteria eschwegii, 6297–6301
Actinopteria humboldti, 6302–6305
Cimitaria sp., 6308
Cimitaria karsteni, 6309, 6310
Cypricardella hartti, 6313–6315
Cypricardella pohli, 6316
Grammysia burmeisteri, 6319
Grammysia gardneri, 6320
Grammysia lundi, 6321, 6322
Grammysia pissisi, 6323, 6324
Liopteria browni, 6327
Modiomorpha helmreicheni, 6328–6330
Modiomorpha sellowi, 6332–6334
Nucula bellistriata *var.* parvula, 6335
Nuculites smithi, 6341
Palaeoneilo orbignyi, 6342–6345
Sphenotus bodenbenderi, 6348–6350
Toechomya freitasi, 6356, 6357
Toechomya rathbuni, 6358, 6359

**Gastropoda**

Bellerophon steltzneri, 6361
Bucania freitasi, 6362
Bucaniella réissi, 6363
Diaphorostoma ? agassizi, 6365
Diaphorostoma darwini, 6366
Diaphorostoma furmanianum, 6367
Platyceras hartti, 6368
Platyceras hussaki, 6369, 6370
Platyceras steinmanni, 6371
Platyceras symmetricum *var.* maecuruense, 6372
Platyceras whitii, 6373, 6374
Plectonotus derbyi, 6375, 6376
Plectonotus ? salteri, 6377
Ptomatis forbesi, 6379

## ERERÉ GROUP

**Vermes**

Tentaculites eldredgianus, 6268

**Lamellibranchiata**

Edmondia sylvana, 6317
Goniophora woodwardi, 6318
Grammysia ulrichi, 6325
Guerangeria (or Nyassa) ortoni, 6326
Modiomorpha pimentana, 6331
Nuculites branneri, 6336–6338
Nuculites ererensis, 6339, 6340
Palaeoneilo pondiana, 6346
Palaeoneilo sulcata, 6347
Sphynotus gorceixi, 6351, 6352

**Gastropoda**

Bellerophon morganianus, 6360
Pleurotomaria rochana, 6378

# INDEX

Appendix 1

# Economic geology 16

*Museum bulletin* 112

16 Mining and Quarry Industry 1906

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# New York State Museum

JOHN M. CLARKE, Director

**Bulletin 112**
ECONOMIC GEOLOGY 16

# THE MINING AND QUARRY INDUSTRY

OF

# NEW YORK STATE

## REPORT OF OPERATIONS AND PRODUCTIONS DURING 1906

BY

D. H. NEWLAND

*New York State Education Department*
*Science Division, April* 16, 1907

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

MY DEAR SIR: I communicate herewith for publication as a bulletin of the State Museum, the third annual report on *The Mining and Quarry Industry of New York State* prepared by the Assistant State Geologist.

The public demand for these publications is urgent and I suggest that the printing of this report be forwarded without delay.

Very respectfully yours

JOHN M. CLARKE

*Director*

*State of New York*
**Education Department**
COMMISSIONER'S ROOM

*Approved for publication this 18th day of April 1907*

A. S. Draper

*Commissioner of Education*

New York State Education Department

# New York State Museum

JOHN M. CLARKE, Director

Bulletin 112

ECONOMIC GEOLOGY 16

# THE MINING AND QUARRY INDUSTRY

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# NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1906

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## PREFACE

The present bulletin — the third of the series to bear the same title — carries forward the plan of issuing a report each year on the mineral industry of New York. The series is intended to afford a summary of the current discoveries, developments and production of the useful mineral materials, each volume being prepared as soon after the close of the year as practicable. With this report the information is brought down to the end of 1906.

It is desired again to express grateful acknowledgment for the assistance rendered by those engaged in mining and quarry enterprises within the State; the requests for information have met with a uniform consideration on their part which has greatly facilitated the preparation of the report.

## INTRODUCTION

The mineral industries of New York have continued to experience during the past year the conditions of general prosperity and advancement noticed in the previous report for 1905. A summary of the returns received from producers distributed among the different branches which are represented in the State shows a valuation for the year's output of $37,118,430. The total takes into account over 30 mineral materials that are commercially exploited. It is to be noted, however, that the valuation is placed upon the materials in their crude or first marketable forms, and no attempt has been made to obtain information relative to the many and varied industries which derive their support from further elaboration of the materials.

The corresponding total reported in 1905 was $35,470,987. In 1904 the value amounted to $28,812,595. The gain for the past year was $1,647,443 or about 5 per cent, while during the two previous years for which statistics have been collected the increase has been $8,305,835 or nearly 30 per cent.

The progress of the iron-mining industry has been one of the notable features of the year's record. The output amounted to 905,367 long tons, the largest reported since 1891, and an increase of 78,318 tons over that for 1905. There were 11 mines in the State under exploitation, the number including three which began production during the year. Exploratory developments have been carried on by several additional companies as a preliminary to active mining. The Fair Haven Iron Co. will begin shipments in the spring from its mine situated at Sterling Station, Cayuga co. The Benson mines in St Lawrence county, the Cheever mine in Essex county and the Salisbury mine in Herkimer county have been under development. The opening of the Lake Sanford titaniferous magnetite deposits, which have recently been transferred to new ownership, is perhaps the most important prospective feature to be recorded in the mining of iron ore.

The manufacture of clay products contributed an aggregate value of $13,955,300 in 1906 as compared with $14,280,016 in the preceding year. The decrease was due principally to the lower prices obtained for structural materials. The output of clay building materials (brick, tile, fireproofing and terra cotta) was valued at $11,063,433. The number of brick made was 1,600,059,000, of which 1,230,692,000 was reported by the plants along the Hudson river. Pottery is a growing branch of the clay-working industry;

its share in the total last year amounted to $1,795,008 represented mostly by the finer wares, porcelain and semiporcelain. There were 265 clay-working plants in operation distributed among 48 counties.

There was little change in the valuation of the products reported by the quarries, the total for 1906 amounting to $6,504,165 against $6,107,147 in the preceding year. The sum was divided according to the various uses into: building stone $1,408,583; monumental stone $103,219; curbing and flagging $999,678; crushed stone $2,435,493; other uses $1,557,192. The output of slate and of limestone used in making Portland and natural cements is not included in the totals.

The plants manufacturing hydraulic cement reported a production of 4,114,939 barrels, consisting of 2,423,374 barrels of Portland cement and 1,691,565 barrels of natural rock cement. There was a large falling off in the natural rock cement, owing to conditions that have developed generally in the cement trade, and for the first time the total was exceeded by that of Portland cement. The combined value of the production was $3,950,699. In 1905 the output amounted to 4,375,520 barrels valued at $3,673,553.

In the salt industry the production has been maintained at an unusually high rate. The total of rock and brine salt reported was 9,013,993 barrels, which is the largest on record. The output for the preceding year amounted to 8,575,649 barrels. There was a slight decrease in the market value — $2,131,650, as compared with $2,303,067 in 1905. A large portion of the brine salt made in New York is used for the manufacture of soda products.

The mines and quarries of gypsum made an output of 262,581 short tons, valued at $685,053. There was a large gain over the previous year when the production amounted to 191,860 tons, valued at $551,193. The increase came mostly from the companies manufacturing wall plaster and plaster of paris.

The combined value of the petroleum and natural gas produced in the State was $2,487,674, against $2,173,931 in 1905. The quantity of petroleum reported was 1,043,088 barrels valued at $1,721,095, or a little more than in the preceding year. The natural gas industry continues to show progress, due to the active developments in Erie and Chautauqua counties. The quantity of gas reported last year was 3,007,086,000 cubic feet, against 2,639,130,000 cubic feet, the total for 1905.

Among the smaller industries which have a firm foothold in New York State are the mining of garnet, graphite and talc. The garnet

product in 1906 amounted to 4729 short tons, valued at $159,298. The graphite produced was 2,811,582 pounds, valued at $96,084. The talc mines reported an output of 64,200 short tons, with a valuation of $541,600.

**Mineral production of New York in 1904**

| PRODUCT | UNIT OF MEASUREMENT | QUANTITY | VALUE |
|---|---|---|---|
| Portland cement | Barrels | 1 377 302 | $1 245 778 |
| Natural rock cement | Barrels | 1 881 630 | 1 207 883 |
| Building brick | Thousands | 1 293 538 | 7 473 122 |
| Pottery | .......... | .......... | 1 438 634 |
| Other clay products | .......... | .......... | 2 592 948 |
| Crude clay | Short tons | 8 959 | 17 164 |
| Emery | Short tons | 1 148 | 17 220 |
| Feldspar and quartz | Long tons | 8 703 | 28 463 |
| Garnet | Short tons | 3 045 | 104 325 |
| Glass sand | Short tons | 11 080 | 8 484 |
| Graphite | Pounds | 3 132 927 | 119 509 |
| Gypsum | Short tons | 151 455 | 424 975 |
| Iron ore | Long tons | 619 103 | 1 328 894 |
| Millstones | .......... | .......... | 21 476 |
| Metallic paint | Short tons | 4 740 | 55 768 |
| Slate pigment | Short tons | 3 132 | 23 876 |
| Mineral waters | Gallons | 8 000 000 | 1 000 000 |
| Natural gas | 1000 cubic feet | 2 399 987 | 552 197 |
| Petroleum | Barrels | 1 036 179 | 1 709 770 |
| Pyrite | Long tons | 5 275 | 20 820 |
| Salt | Barrels | 8 724 768 | 2 102 748 |
| Roofing slate | Squares | 18 090 | 86 159 |
| Slate manufactures | .......... | .......... | 7 441 |
| Granite | .......... | .......... | 221 882 |
| Limestone | .......... | .......... | 2 104 095 |
| Marble | .......... | .......... | 478 771 |
| Sandstone | .......... | .......... | 1 896 697 |
| Trap | .......... | .......... | 468 496 |
| Talc | Short tons | 65 000 | 455 000 |
| Other materials[a] | .......... | .......... | 1 600 000 |
| Total value | .......... | .......... | $28 812 595 |

[a] Includes apatite, carbon dioxid, diatomaceous earth, fullers earth, marl and sand. The value is partly estimated.

**Mineral production of New York in 1905**

| PRODUCT | UNIT OF MEASUREMENT | QUANTITY | VALUE |
|---|---|---|---|
| Portland cement | Barrels | 2 117 822 | $2 046 864 |
| Natural rock cement | Barrels | 2 257 698 | 1 590 689 |
| Building brick | Thousands | 1 512 157 | 10 054 597 |
| Pottery | .......... | .......... | 1 620 558 |
| Other clay products | .......... | .......... | 2 603 861 |
| Crude clay | Short tons | 6 766 | 16 616 |
| Emery | Short tons | 1 475 | 12 452 |
| Feldspar and quartz | Long tons | 17 000 | 48 500 |
| Garnet | Short tons | 2 700 | 94 500 |
| Glass sand | Short tons | 9 850 | 7 765 |
| Graphite | Pounds | 3 897 616 | 142 948 |
| Gypsum | Short tons | 191 860 | 551 193 |
| Iron ore | Long tons | 827 049 | 2 576 123 |
| Millstones | .......... | .......... | 22 944 |
| Metallic paint | Short tons | 6 059 | 70 090 |
| Slate pigment | Short tons | 2 929 | 22 668 |
| Mineral waters | Gallons | 8 000 000 | 1 000 000 |
| Natural gas | 1000 cubic feet | 2 639 130 | 607 000 |
| Petroleum | Barrels | 949 511 | 1 566 931 |
| Pyrite | Long tons | 10 100 | 40 465 |
| Salt | Barrels | 8 575 649 | 2 303 067 |
| Roofing slate | Squares | 16 460 | 94 009 |
| Slate manufactures | .......... | .......... | 1 000 |
| Granite | .......... | .......... | 253 955 |
| Limestone | .......... | .......... | 2 411 456 |
| Marble | .......... | .......... | 774 557 |
| Sandstone | .......... | .......... | 2 043 960 |
| Trap | .......... | .......... | 623 219 |
| Talc | Short tons | 67 000 | 469 000 |
| Other materials[a] | .......... | .......... | 1 800 000 |
| Total value | .......... | .......... | $35 470 987 |

[a] Includes apatite, carbon dioxid, diatomaceous earth, fullers earth, marl, sand and sand lime brick. The value is partly estimated.

**Mineral production of New York in 1906**

| PRODUCT | UNIT OF MEASUREMENT | QUANTITY | VALUE |
|---|---|---|---|
| Portland cement | Barrels | 2 423 374 | $2 766 488 |
| Natural rock cement | Barrels | 1 691 565 | 1 184 211 |
| Building brick | Thousands | 1 600 059 | 9 688 289 |
| Pottery | .......... | .......... | 1 795 008 |
| Other clay products | .......... | .......... | 2 472 003 |
| Crude clay | Short tons | 5 477 | 9 125 |
| Emery | Short tons | 1 307 | 13 870 |
| Feldspar and quartz | Long tons | 13 660 | 44 350 |
| Garnet | Short tons | 4 729 | 159 298 |
| Glass sand | Short tons | 9 000 | 8 600 |
| Graphite | Pounds | 2 811 582 | 96 084 |
| Gypsum | Short tons | 262 581 | 685 053 |
| Iron ore | Long tons | 905 367 | 3 393 609 |
| Millstones | .......... | .......... | 22 442 |
| Metallic paint | Short tons | 2 714 | 29 140 |
| Slate pigment | Short tons | 2 045 | 15 960 |
| Mineral waters | Gallons | 8 000 000 | 1 000 000 |
| Natural gas | 1000 cubic feet | 3 007 086 | 766 579 |
| Petroleum | Barrels | 1 043 088 | 1 721 095 |
| Pyrite | Long tons | 11 798 | 35 550 |
| Salt | Barrels | 9 013 993 | 2 131 650 |
| Roofing slate | Squares | 16 248 | 57 771 |
| Slate manufactures | .......... | .......... | 4 150 |
| Sand lime brick | Thousands | 17 080 | 122 340 |
| Granite | .......... | .......... | 255 189 |
| Limestone | .......... | .......... | 2 963 829 |
| Marble | .......... | .......... | 460 915 |
| Sandstone | .......... | .......... | 1 976 829 |
| Trap | .......... | .......... | 847 403 |
| Talc | Short tons | 64 200 | 541 600 |
| Other materials*a* | .......... | .......... | 1 850 000 |
| Total value | .......... | .......... | $37 118 430 |

*a* Includes apatite, arsenical ore, carbon dioxid, diatomaceous earth, fullers earth, marl, and sand and gravel exclusive of glass sand.

## ARSENICAL ORE

Several hundred tons of arsenical ore were mined in New York State last year. A part of the output was sold to reduction works for manufacture into arsenical compounds. Though deposits of this ore have been worked previously in the State, it is probably the first time that they have supplied any commercial product.

The ores known to occur in New York include arsenopyrite, leucopyrite and scorodite. The first named, a sulfarsenid of iron with 46% arsenic, is the most abundant. It is also the principal variety employed in the trade. It occurs in Orange, Putnam and Essex counties, in veins which intersect the older crystalline rocks.

The deposit which has been under operation during 1906, is situated near Pine pond, town of Kent, Putnam co. It has been known for many years and was the object of exploration as early as 1847. The operations were abandoned, however, after a little preliminary work. In 1888 a small quantity of ore was mined and shipped to New Jersey, evidently for other purposes than the utilization of the arsenic as no plant for treating the ore is located in that state. The present company, the Putnam County Mining Corporation, undertook the development of the property in April, 1906. Of the ore that has been mined, a portion amounting to a few hundred tons was found to contain sufficient arsenic to be shipped in crude condition and was sold to metallurgical establishments abroad. The low grade ore has been held in stock with a view to future concentration, for which a special plant will have to be built.

So far as revealed by existing developments, the deposit appears to be a vein-intersecting gneiss which is the prevailing formation in this section and includes both igneous and sedimentary varieties. The vein lies near the base of a prominent ridge, southwest of Pine pond. It has a northerly strike. In close proximity and running parallel is a dike of basic rock, the outcropping portion of which is completely changed to serpentine. The dike rises above the surface as a distinct ridge that can be traced for half a mile or more along the strike and shows a width of from 100 to 300 yards. It is probably a peridotite, though the nature of the original components can only be inferred from the general appearance and texture.

The vein consists of white flinty quartz with varying proportions of arsenopyrite and pyrite. In places the metallic minerals occur in solid mass, but usually they are distributed through the quartz. Pyrite is much less abundant of the two; its distribution being very irregular. Both are seldom crystallized. The percentage of metallic arsenic in the ore ranges nearly up to the theoretical amount required by the chemical formula. With hand sorting a fairly large proportion will assay above 25% which is considered marketable grade. For the following complete analysis of the ore the writer is indebted to Mr George Wishart, manager of the mine.

| | |
|---|---|
| Silica ($SiO_2$) | 2.90 |
| Iron (Fe) | 36.11 |
| Copper (Cu) | 2.17 |
| Sulfur (S) | 22.72 |
| Arsenic (As) | 36.00 |
| | 99.90 |

The copper shown by the analysis is probably present in the pyrite. This mineral usually has the deep yellow color characteristic of the copper-bearing variety.

An analysis of the dike, which has also been reported by Mr Wishart, is sufficiently interesting to deserve record. It establishes the ultra-basic nature of the rock and is in agreement with the view above expressed that it is an altered peridotite.

| | |
|---|---|
| Silica ($SiO_2$) | 35.50 |
| Alumina ($Al_2O_3$) | 4.52 |
| Ferric oxid ($Fe_2O_3$) | 7.40 |
| Lime (CaO) | 2.60 |
| Magnesia (MgO) | 37.64 |
| Carbon dioxid ($CO_2$)<br>Water ($H_2O$) | 13.30 |
| | 100.96 |

Arsenopyrite has been reported by Beck[1] and Whitlock[2] near Edenville and at other places in Orange county and in the town of Lewis, Essex co., 10 miles south of Keeseville. At the first named locality it is associated with leucopyrite, the disarsenid of iron and scorodite, a hydrous arsenate of iron; the wall rock is crystalline limestone.

## CARBON DIOXID

The production of natural carbonic acid gas as an industry is confined to the vicinity of Saratoga Springs. There are no other localities in this country where the gas is recovered from natural sources and marketed, though a large production is made by the decomposition of mineral carbonates, combustion of coke and in other ways.

The companies engaged in this industry at Saratoga Springs include the following: New York Carbonic Acid Gas Co., Natural Carbonic Gas Co., Lincoln Spring Co., Geysers Natural Carbonic Acid Gas Co., and the Champion Natural Carbonic Acid Gas Co.

The phenomena of occurrence and the methods used in collecting and storage of the gas for market have been described in the preceding issue of this publication. There have been no new features in the industry during the past year, except that the production

1 Mineralogy of New York. 1842.
2 List of New York Mineral Localities, N. Y. State Mus. Bul. 70. 1903.

has increased about 25 per cent. According to an estimate made by J. C. Minor jr, the quantity recovered was about 5,000,000 pounds, compared with 4,000,000 pounds in 1905. The gain has been due rather to the perfection of the methods for saving the gas than to drilling of additional wells.

## CEMENT

The conditions in the cement industry were, on the whole, very favorable during the past year. There was an unusual demand for cement within the State, due to the general activity of building and construction and specially to the carrying out of important engineering undertakings in connection with the canal system and the railroad terminals of New York city. As a consequence the companies were able to market their entire output for the year without difficulty. The prices have also been higher than for some time past.

In all there were 19 firms that reported a production in 1906, as compared with 21 firms similarly reporting in the previous year. The combined output of Portland and natural rock cement amounted to 4,114,939 barrels valued at $3,950,699. In 1905 the output was 4,375,520 barrels valued at $3,673,553, so that there was a loss for the year of 260,581 barrels in the quantity produced, but a gain of $277,196 in the value. The decreased production was brought about by the conditions incidental to the natural rock cement trade which has lost a good deal of its former importance in this State as elsewhere.

The output of Portland cement amounted to 2,423,374 barrels valued at $2,766,488 against 2,117,822 barrels valued at $2,046,864 in 1905. There were 10 companies in operation, a gain of one for the year. The Cummings Cement Co., at Akron, Erie co., which had closed down its plant for repairs and new machinery, was again productive. The company makes both Portland and natural rock cement. Important improvements have been made in the plant of the Glens Falls Cement Co., including the installation of rotary kilns in the place of upright kilns.

The production of natural rock cement amounted to 1,691,565 barrels valued at $1,184,211. In 1905 the total was 2,257,698 barrels valued at $1,590,689. As heretofore the Rosendale district has contributed most of the output, its share having been 1,514,336 barrels with a value of $1,107,535. In 1905 this district produced 1,977,698 barrels valued at $1,472,489. Onondaga county reported a total of 63,043 barrels valued at $30,923, against 77,000 barrels

valued at $31,500 in the previous year. The remainder of the output came from Erie county. In all there were nine plants active, or three less than in 1905. The Buffalo Cement Co., of Buffalo and the Potter-Brown Cement Works at Manlius, Onondaga co., were inoperative and will probably not resume the manufacture of natural rock cement. The Akron Cement Works also suspended operations.

**Production of cement in New York**

| YEAR | PORTLAND CEMENT | | NATURAL CEMENT | |
|---|---|---|---|---|
| | Barrels | Value | Barrels | Value |
| 1890 | 65 000 | $140 000 | 3 776 756 | $2 985 513 |
| 1891 | 87 000 | 190 250 | 3 931 306 | 3 046 279 |
| 1892 | 124 000 | 279 000 | 3 780 687 | 3 074 781 |
| 1893 | 137 096 | 287 725 | 3 597 758 | 2 805 387 |
| 1894 | 117 275 | 205 231 | 3 446 330 | 1 974 463 |
| 1895 | 159 320 | 278 810 | 3 939 727 | 2 285 094 |
| 1896 | 260 787 | 443 175 | 4 181 918 | 2 423 891 |
| 1897 | 394 398 | 690 179 | 4 259 186 | 2 123 771 |
| 1898 | 554 358 | 970 126 | 4 157 917 | 2 065 658 |
| 1899 | 472 386 | 708 579 | 4 689 167 | 2 813 500 |
| 1900 | 465 832 | 582 290 | 3 409 085 | 2 045 451 |
| 1901 | 617 228 | 617 228 | 2 234 131 | 1 117 066 |
| 1902 | 1 156 807 | 1 521 553 | 3 577 340 | 2 135 036 |
| 1903 | 1 602 946 | 2 031 310 | 2 417 137 | 1 510 529 |
| 1904 | 1 377 302 | 1 245 778 | 1 881 630 | 1 207 883 |
| 1905 | 2 117 822 | 2 046 864 | 2 257 698 | 1 590 689 |
| 1906 | 2 423 374 | 2 766 488 | 1 691 565 | 1 184 211 |

## CLAY

The manufacture of brick and other clay products is the most important branch of the mineral industry in New York. Clay deposits suitable for making the common wares are distributed throughout every section in practically inexhaustible quantities. The rapidly growing market for these products has led to the establishment of numerous manufacturing plants in recent years, so that now there is scarcely an industrial center of any size in which they are not produced. This is particularly true with regard to the manufacture of building materials, which are being employed more and more widely as an element in permanent construction. Owing to their cheapness, durability and the convenience with which they can be adapted to meet the varied architectural requirements, the use of these materials will doubtless continue to expand for a long time to come.

The manufacture of the finer grades of clay wares has not developed so rapidly as the other lines. In contrast with most of the states along the Atlantic seaboard, New York possesses almost no deposits of kaolin in quantity to be of economic value. This fact has hitherto retarded the establishment of industries in which kaolin is employed, but with improved facilities of transport, the deficiency has become less formidable to local manufacturers. There are now several plants in the State making tableware, electrical supplies and other porcelain and semiporcelain wares.

## Production of clay materials

The unprecedented demand for clay building materials which was experienced in nearly all sections of the State throughout the previous year, continued to exert a favorable influence on the clayworking industries during 1906. For the first part of the year the output of building brick was specially large. Under the stimulus of the high prices received during 1905, a number of new plants were placed in operation, while many of the old ones were improved and enlarged, resulting in a considerable increase of the aggregate capacity. During the first few months of the year the demand was sufficient to absorb the entire output, but before the summer was well advanced a gradual slackening of building operations began to be felt in the large cities and became more pronounced toward the end of the season. With the falling off in the demand, manufacturers cut down their production to some extent so that their average for the year was about on the same scale as in 1905.

The aggregate value of the production of clay materials of all kinds for 1906 was $13,955,300. There were 265 companies or individuals actively engaged in the industry, as compared with 250 in the preceding year. Of the 61 counties of the State, 48 were represented in the returns as having an output of clay materials. Compared with the production of 1905, which was valued at $14,280,016, there was a decrease of $324,716, or about 2 per cent. The falling off in the valuation of building brick alone more than equalled the aggregate decline.

The value of the output of common building brick for the year amounted to $9,302,165, as compared with $9,751,753 in 1905 Front brick and fancy building brick aggregated $386,124, as compared with $302,844; vitrified paving brick $178,011, against $180,004; and fire brick and stove lining $527,659, against $498,184 in the preceding year. The manufacture of drain tile amounted to

$166,645 against $146,790; and sewer pipe to $95,142, against $444,-457. The product of terra cotta was valued at $1,037,387, as compared with $874,717 in 1905; fireproofing at $120,282, as compared with $133,995; and building tile at $217,475, as compared with $251,600. In addition there were produced miscellaneous materials, including flue lining, fire tile and shapes, conduit pipes, sidewalk brick and acid-proof brick, the collected value of which amounted to $129,402, against $74,114 in 1905. The potteries of the State reported an output valued at $1,795,008, as compared with a value of $1,620,558 in the preceding year.

**Production of clay materials**

| MATERIAL | 1904 | 1905 | 1906 |
|---|---|---|---|
| Common brick | $7 234 876 | $9 751 753 | $9 302 165 |
| Front brick | 238 246 | 302 844 | 386 124 |
| Vitrified paving brick | 210 707 | 180 004 | 178 011 |
| Fire brick and stove lining | 506 800 | 498 184 | 527 659 |
| Drain tile | 149 864 | 146 790 | 166 645 |
| Sewer pipe | 460 000 | 444 457 | 95 142 |
| Terra cotta | 798 028 | 874 717 | 1 037 387 |
| Fireproofing | 157 119 | 133 995 | 120 282 |
| Building tile | 206 503 | 251 600 | 217 475 |
| Miscellaneous | 103 927 | 75 114 | 129 402 |
| Pottery | 1 438 634 | 1 620 558 | 1 795 008 |
| Total | $11 504 704 | $14 280 016 | $13 955 300 |

The distribution of the production according to the counties in which it was made shows that Rockland county has the largest clay-working industry. The value of its output in 1906 was $1,767,012. It also led the list of counties in 1905 with an aggregate value of $2,144,210. Ulster county ranks second in importance, its total being $1,465,457, as compared with $1,776,035 in the preceding year. Orange county, which was fourth in 1905, advanced to third place last year with a total of $1,170,695, against $1,011,006. Onondaga county ranks fourth with a value of $1,094,635, against $932,285, the greater part of its production being pottery. Dutchess county moved from third place in 1905, when it reported a value of $1,258,-937, to fifth in 1906, with a valuation of $975,410. The other counties that reported a production valued at $100,000 or over in 1906 are: Richmond ($896,789); Erie ($804,159); Albany ($675,099); Kings ($575,973); Westchester ($536,189); Columbia

($489,750); Greene ($399,298); Saratoga ($388,450); Ontario ($343,040); Monroe ($341,870); Rensselaer ($296,762); Steuben ($209,052); Nassau ($163,700); Suffolk ($138,500); Allegany ($111,683); Oneida ($103,263); and Queens county, the total of which is withheld in order not to reveal the figures reported by the single producer.

**Production of clay materials by counties**

| COUNTY | 1904 | 1905 | 1906 |
|---|---|---|---|
| Albany | $648 973 | $624 238 | $675 099 |
| Allegany | 127 552 | 118 989 | 111 683 |
| Broome | 22 000 | 18 000 | 12 000 |
| Cayuga | 24 520 | 25 920 | 17 860 |
| Chautauqua | 83 405 | 78 130 | 99 085 |
| Chemung | 96 300 | 96 000 | 90 000 |
| Clinton | 5 000 | 5 900 | 4 800 |
| Columbia | 420 500 | 520 500 | 489 750 |
| Dutchess | 932 907 | 1 258 937 | 975 410 |
| Erie | 647 334 | 700 527 | 804 159 |
| Fulton | 4 000 | 1 700 | 2 600 |
| Greene | 232 924 | 389 562 | 399 298 |
| Jefferson | 30 467 | 36 502 | 36 722 |
| Kings | 539 288 | 565 888 | 575 973 |
| Madison | 16 400 | 12 000 | 16 800 |
| Monroe | 658 058 | 644 411 | 341 870 |
| Nassau | 52 644 | 76 992 | 163 700 |
| Niagara | 16 892 | 3 272 | 10 832 |
| Oneida | 145 880 | 133 250 | 103 263 |
| Onondaga | 916 954 | 932 285 | 1 094 635 |
| Ontario | 245 743 | 345 250 | 343 040 |
| Orange | 690 064 | 1 011 006 | 1 170 695 |
| Rensselaer | 257 751 | 263 256 | 296 762 |
| Richmond | 488 873 | 645 367 | 896 789 |
| Rockland | 1 422 436 | 2 144 210 | 1 767 012 |
| Saratoga | 331 360 | 362 268 | 388 450 |
| Seneca | 19 175 | 3 525 | 39 525 |
| Steuben | 176 613 | 164 663 | 209 052 |
| Suffolk | 86 112 | 113 000 | 138 500 |
| Tompkins | 17 715 | 15 004 | *a* |
| Ulster | 1 274 284 | 1 776 035 | 1 465 457 |
| Warren | 28 625 | 45 712 | 34 500 |
| Washington | 15 755 | 20 270 | 22 033 |
| Westchester | 354 705 | 592 705 | 536 189 |
| Other counties*b* | 473 495 | 534 742 | 621 757 |
| Total | $11 504 704 | $14 280 016 | $13 955 300 |

*a* Included under "other counties."
*b* Includes in 1905: Genesee, Montgomery, New York, Queens, St Lawrence, Schenectady, Wayne and Wyoming counties. In 1906 the following counties are included: Cattaraugus, Genesee, Herkimer, Livingston, Montgomery, New York, Queens, St Lawrence, Schenectady, Tioga, Tompkins and Wayne.

## Manufacture of building brick

The output of common building brick in 1906 amounted to 1,575,-434,000, valued at $9,302,165. In addition there were made 24,-625,000 front and fancy pressed brick, valued at $386,124; making an aggregate output of brick for building purposes of 1,600,059,000, valued at $9,688,289. The total quantity manufactured in the preceding year was 1,512,157,000, valued at $10,054,597, consisting of

**Production of common building brick**

| COUNTY | 1905 | | 1906 | |
|---|---|---|---|---|
| | Number | Value | Number | Value |
| Albany | 66 500 000 | $439 238 | 74 083 000 | $461 399 |
| Allegany | 1 092 000 | 6 957 | *a* | *a* |
| Broome | 3 000 000 | 18 000 | 2 000 000 | 12 000 |
| Cayuga | 3 416 000 | 21 520 | 2 215 000 | 13 310 |
| Chautauqua | 8 885 000 | 49 992 | 8 567 000 | 52 031 |
| Chemung | 15 600 000 | 96 000 | 15 000 000 | 90 000 |
| Clinton | 1 100 000 | 5 900 | 800 000 | 4 800 |
| Columbia | 84 750 000 | 520 500 | 84 500 000 | 489 750 |
| Dutchess | 181 683 000 | 1 258 937 | 167 132 000 | 975 410 |
| Erie | 54 269 000 | 282 859 | 56 302 000 | 319 365 |
| Greene | 55 719 000 | 377 470 | 64 690 000 | 390 748 |
| Jefferson | 4 900 000 | 36 502 | 5 100 000 | 36 722 |
| Monroe | 24 176 000 | 139 320 | 26 077 000 | 158 463 |
| Nassau | 8 240 000 | 58 872 | 22 000 000 | 125 000 |
| Niagara | *a* | *a* | 2 172 000 | 10 832 |
| Oneida | 17 046 000 | 86 769 | 20 550 000 | 100 825 |
| Onondaga | 16 889 000 | 104 134 | 22 387 000 | 127 494 |
| Ontario | 3 000 000 | 18 000 | 3 510 000 | 21 700 |
| Orange | 160 530 000 | 1 011 006 | 189 180 000 | 1 170 695 |
| Rensselaer | 25 250 000 | 133 350 | 31 776 000 | 173 906 |
| Richmond | *a* | *a* | 34 769 000 | 172 880 |
| Rockland | 302 625 000 | 2 144 210 | 296 145 000 | 1 767 012 |
| St Lawrence | 600 000 | 4 200 | *a* | *a* |
| Saratoga | 62 335 000 | 319 569 | 70 509 000 | 385 950 |
| Seneca | 50 000 | 400 | 6 050 000 | 36 400 |
| Steuben | 2 000 000 | 21 300 | 4 705 000 | 31 800 |
| Suffolk | 17 250 000 | 110 000 | 21 710 000 | 137 500 |
| Tompkins | 2 021 000 | 15 004 | *a* | *a* |
| Ulster | 265 368 000 | 1 776 035 | 252 665 000 | 1 465 457 |
| Warren | 8 763 000 | 45 712 | *a* | *a* |
| Washington | 2 300 000 | 11 800 | 3 300 000 | 18 100 |
| Westchester | 76 893 000 | 530 465 | 70 621 000 | 458 000 |
| Other counties*b* | 17 209 000 | 107 732 | 16 919 000 | 94 606 |
| Total | 1 493 459 000 | $9 751 753 | 1 575 434 000 | $9 302 165 |

*a* Included under "other counties."
*b* Includes in 1905 the following: Fulton, Herkimer, Livingston, Montgomery, Richmond, Tioga and Wyoming. In 1906 the following counties are included: Allegany, Cattaraugus, Fulton, Herkimer, Livingston, Montgomery, St Lawrence, Schenectady, Tioga, Tompkins and Warren.

1,493,459,000 common brick, valued at $9,751,753 and 18,698,000 front and fancy bricks valued at $302,844. The manufacture of these materials was carried on in 37 counties by a total of 213 companies or individuals. In 1905 there were 39 counties represented with a total of 192 plants.

The average price received for common brick last year was $5.98 a thousand, as compared with $6.53 a thousand in 1905 and $5.67 a thousand the average for 1904. Front and fancy pressed brick averaged $15.68 a thousand against $16.20 in 1905 and $13.48 in 1904.

**Hudson river region.** The counties in New York State situated along the Hudson river are specially favored in respect to the manufacture of building brick. New York city and vicinity, with its rapidly increasing population, is by far the greatest market for such materials in the United States. There exist enormous clay deposits, suitable for making the common grades of brick, on either side of the river from Rensselaer and Albany counties down to Rockland and Westchester, while the river itself affords a convenient and cheap means of transportation direct from the yards to the market. As a result of these conditions the brick industry of this section has developed to proportions that are without parallel in any other part of the country.

In 1906 the output of common brick in the Hudson river region amounted to a total of 1,230,692,000. This is approximately 78 per cent of the whole output of common brick in the State. The value of the production was $7,352,377. In the preceding year the output was 1,219,318,000, valued at $8,191,211. There was thus a gain of 11,374,000 in quantity, but a loss of $838,834 in value. The number of companies reporting as active was 131, an increase of 12 for the year, or 20 more than in 1904. Rockland county was represented by the largest number, 33, and its production amounted to 296,145,000, valued at $1,767,012. Ulster county, with 26 operative companies, produced 252,665,000, valued at $1,465,457; and Orange county made 189,180,000, valued at $1,170,695, reported by 12 companies.

The average number of brick made in each plant in 1906 was 9,471,000, as compared with 10,246,000 in 1905 and 9,180,000 in 1904. The price for the whole region averaged during the year $5.98 a thousand against $6.54 a thousand for 1905 and $5.79 a thousand for 1904.

The main feature of the past year's record was the remarkable range in the market prices received for brick in the New York

market. Owing to the great building activity that prevailed during 1905, the whole product of that year was practically disposed of by the close of the brick-making season, and the plants carried little or no stock through the winter. Before the opening of the yards in the spring of 1906 there was a veritable brick famine. Prices reached an unprecedented high level; as much as $10 and

**Output of common brick in the Hudson river region in 1905**

| COUNTY | NUMBER OF PLANTS | OUTPUT | VALUE | AVERAGE PRICE PER M |
|---|---|---|---|---|
| Albany | 8 | 66 500 000 | $439 238 | $6 61 |
| Columbia | 5 | 84 750 000 | 520 500 | 6 09 |
| Dutchess | 17 | 181 683 000 | 1 258 937 | 6 93 |
| Greene | 7 | 55 719 000 | 377 470 | 6 77 |
| Orange | 12 | 160 530 000 | 1 011 006 | 6 67 |
| Rensselaer | 8 | 25 250 000 | 133 350 | 5 28 |
| Rockland | 31 | 302 625 000 | 2 144 210 | 7 08 |
| Ulster | 23 | 265 368 000 | 1 776 035 | 6 69 |
| Westchester | 8 | 76 893 000 | 530 465 | 6 90 |
| Total | 119 | 1 219 318 000 | $8 191 211 | $6 54 |

**Output of common brick in the Hudson river region in 1906**

| COUNTY | NUMBER OF PLANTS | OUTPUT | VALUE | AVERAGE PRICE PER M |
|---|---|---|---|---|
| Albany | 11 | 74 083 000 | $461 399 | $6 23 |
| Columbia | 6 | 84 500 000 | 489 750 | 5 80 |
| Dutchess | 19 | 167 132 000 | 975 410 | 5 82 |
| Greene | 6 | 64 690 000 | 390 748 | 6 04 |
| Orange | 12 | 189 180 000 | 1 170 695 | 6 19 |
| Rensselaer | 9 | 31 776 000 | 173 906 | 5 48 |
| Rockland | 33 | 296 145 000 | 1 767 012 | 5 97 |
| Ulster | 26 | 252 665 000 | 1 465 457 | 5 80 |
| Westchester | 9 | 70 621 000 | 458 000 | 6 46 |
| Total | 131 | 1 230 692 000 | $7 352 377 | $5 98 |

even $12 a thousand was paid for the available supply. With the resumption of manufacture they rapidly fell to $8 or $9, and as the season advanced they continued to decline due to a slackening in building operations. As the plants had been brought up

to their highest efficiency in anticipation of a profitable season, there were also unusually large quantities offered upon the market. In the last months of the season, the prices fell to about $5 a thousand at the yard and held at that level throughout the remainder of the year, with small demand. At the end of the year the stock held by the companies along the river was probably in excess of 300,000,000, or fully 25 per cent of the whole output. A radical curtailment of operations is to be expected for the current season.

### Other clay materials

The manufacture of paving brick was carried on during 1906 in Chautauqua, Greene, Onondaga and Steuben counties. There were five companies engaged in the business and the output was 11,472,000, valued at $178,011. In 1905 there were six companies which reported a production of 13,984,000, valued at $180,004.

Fire brick and stove lining were manufactured in Albany, Chautauqua, Erie, Kings, Onondaga, Rensselaer, Richmond, Schenectady, Washington and Westchester counties by a total of 13 companies. The output of fire brick amounted to 12,091,413, valued at $413,147, and the stove lining was valued at $114,512, a combined value of $527,659. In 1905 the value of the two materials was $498,184 reported by 13 companies.

Drain tile and sewer pipe were made in Albany, Cayuga, Chautauqua, Erie, Genesee, Kings, Madison, Monroe, Oneida, Onondaga, Ontario, Saratoga, Seneca, Washington and Wayne counties. The output of drain tile was valued at $166,645, against $146,790 in 1905; and sewer pipe at $95,142, against $444,457. There were 26 companies engaged in this branch of the industry, a gain of two as compared with the previous year.

Terra cotta, fireproofing and building tile were produced in Albany, Allegany, Chautauqua, Erie, Genesee, Kings, Monroe, Onondaga, Ontario, Queens, Rensselaer, Richmond and Steuben counties, by a total of 17 companies, or three less than in 1905. The production of terra cotta was valued at $1,037,387, against $874,717 in 1905; fireproofing at $120,282, against $133,395; and building tile at $217,475, against $251,600.

### New manufacturers of clay materials

The following list includes the names of the companies or individuals who have erected plants during the past year, or have taken over old plants, for the manufacture of clay structural materials. The list is supplementary to the one published in the report for 1905.

| NAME | LOCATION OF PLANT |
|---|---|
| **Albany co.** | |
| Corwin & McCullough | Coeymans |
| Powell & Minnock | Coeymans |
| C. A. Smith | Albany |
| Edward J. Smith & Co. | Albany |
| Ziegler & Ziegler | Coeymans |
| **Dutchess co.** | |
| Harlem Valley Brick & Supply Co. | Amenia |
| John Nicholson | Dutchess Junction |
| **Herkimer co.** | |
| Staley & Co. | Ilion |
| **Orange co.** | |
| George W. Hunt | Chelsea |
| **Rensselaer co.** | |
| Palmer Bros. | Troy |
| Rensselaer Brick Co. | Rensselaer |
| G. L. Tobin | Castleton |
| **Richmond co.** | |
| Rossville Brick Co. | Rossville |
| **Rockland co.** | |
| Lynch & O'Brien | Haverstraw |
| Reilly & Marks | Stony Point |
| West Haverstraw Brick Co. | West Haverstraw |
| **Schenectady co.** | |
| Cady & Vandenbergh | Schenectady |
| Electric City Clay Brick Co. | Glenville |
| **Suffolk co.** | |
| The Brown Clay Works | Fort Salonga |
| **Ulster co.** | |
| Lowe Brick Co. | New Paltz |
| Estate of A. S. Staples | Port Ewen |
| Ulster Brick Co. | Saugerties |
| W. M. Burhans, Executor | Saugerties |

## Pottery

The manufacture of pottery has become an important branch of the clay-working industry of the State. Its development, however, has been due rather to the exceptional facilities afforded by the State for manufacturing and marketing the products than to the existence of natural resources of crude materials that are employed in the potteries. With the exception of the deposits of slip clay in Albany county and a limited supply of stoneware clays in Onondaga county, the raw materials are derived entirely from

without the State. The kaolin used comes from New Jersey and from England, the feldspar from Canada, and much of the pottery clay from New Jersey.

In the accompanying table is shown the value of the pottery manufactures during the past three years. The total valuation of the product for 1906, as returned by the individual plants, was $1,795,008. The preceding year's output was valued at $1,620,558 and that of 1904 at $1,438,634. The growth of the industry during the period has been brought about by the increased production of the high grade products — porcelain and semiporcelain tablewares and electric and sanitary supplies. The manufacture of stoneware and earthenware has remained almost stationary. The products listed in the table under "Miscellaneous" include yellow and Rockingham wares, clay tobacco pipes, fire clay crucibles and artistic pottery.

There were 22 potteries that reported as active in 1906, the same number as in the two preceding years. They were distributed among the following counties: Albany, Chautauqua, Erie, Kings, Madison, Monroe, Nassau, Onondaga, Ontario, Schenectady, Suffolk, Washington and Wayne. Onondaga holds first place in point of production, with a total for 1906 valued at $858,270, as compared with $718,985 in 1905 and $673,590 in 1904. Kings county is the second largest producer, contributing an output valued at $306,105, against $308,443 in the preceding year and $279,009 in 1904.

The Rochester City Pottery of Rochester making earthenware and the Van Der Meulen & Wylstra Art Pottery Co., of Dunkirk, making delft reported an output in 1906 for the first time.

**Value of production of pottery**

| WARE | 1904 | 1905 | 1906 |
|---|---|---|---|
| Stoneware | $77 726 | $115 890 | $84 031 |
| Red earthenware | 44 990 | 30 740 | 30 234 |
| aPorcelain and semiporcelain | 740 000 | 800 000 | 835 000 |
| Electric and sanitary supplies | 490 095 | 600 325 | 768 236 |
| Miscellaneous | 85 823 | 73 603 | 77 507 |
| Total | $1 438 634 | $1 620 558 | $1 795 008 |

a Includes china tableware.

### Crude clay

In the foregoing tables relating to clay products no account has been taken of the crude clay entering into their manufacture. There are a few producers in the State who do not utilize the crude clay themselves, but ship their output to others for manufacture. Some of the material, like the Albany slip clay for example, is even forwarded to points without the State. In 1906, returns were received from four firms engaged in this industry whose total shipments amounted to 5477 short tons valued at $9125. The corresponding total for 1905 was 6766 tons with a value of $16,616 and for 1904 8959 tons with a value of $17,164.

## EMERY

The emery deposits near Peekskill were worked on about the usual scale during the past year. The output reported by the four producers that were active amounted to 1307 short tons valued at $13,870. This compares with a total of 1475 tons valued at $12,452 in 1905 and 1148 tons with a value of $17,220 in 1904. The valuation is based on the crude material as it comes from the quarries where it undergoes only a rough sorting before shipment. The lump emery is sent to outside points for grinding and manufacture into emery wheels, stones, cloth, etc.

The list of producers in 1906 includes the following: Blue Corundum Mining Co., Easton, Pa., Keystone Emery Mills, Frankford, Pa., J. R. Lancaster, Peekskill and the Tanite Co. Stroudsburg, Pa. The Keystone Emery Mills have taken over the properties formerly worked by H. M. Quinn. With the exception of J. R. Lancaster who sells his product to the Hampden Corundum Wheel Co., of Springfield, Mass., the companies mine the emery for their own consumption in connection with manufacturing plants.

## FELDSPAR

The quarries of feldspar at Bedford, Westchester co., were operated as in previous years by P. H. Kinkel of that place and yielded their average output. In connection with the working of the quarries a considerable quantity of quartz, or flint as it is commonly termed, was obtained. The feldspar was shipped to Trenton, N. J., where it is employed in the manufacture of porcelain wares. An additional source of supply for the mineral received attention during the past year, the locality being in Washington county, about 3 miles north of Fort Ann. The feldspar is found here in

a pegmatite dike. A quarry had been opened some 20 years ago and worked for a time for the quartz which is mixed with the feldspar. Only a small quantity of feldspar was taken out in the past year. The operator of the quarry was Dominic Ashley of Glens Falls. The combined production of feldspar and quartz in New York State amounted in 1906 to 13,660 long tons valued at $44,350. The total for the previous year was 17,000 long tons valued at $48,500.

## GARNET

Though there have been no new sources of supply for garnet, other than those described in the previous report, the mining industry has shown unusual progress during the past year. The demand for the mineral among abrasive manufacturers seems to be expanding rapidly at present.

The occurrence of garnet may be said to be quite widespread in the Adirondacks and other regions where the rock formations have a metamorphosed character. It is only seldom found, however, in deposits of sufficient size and richness and at the same time with the proper physical qualities to warrant commercial exploitation. There is little to be feared, apparently, from a possible overproduction, at least from the present mining sections.

The output from the Adirondack region has been made by three companies: the North River Garnet Co., with mines at Thirteenth lake, Warren co; H. H. Barton & Son Co., who operate the deposits on Gore mountain, near North River; and the American Glue Co., with mines on Garnet peak, north of the latter locality. The first named company has been the largest producer. Its new mill which was first started in 1905 was in continuous operation during the past year. The deposits are so situated that they can be worked through the winter. At the other localities where the garnet is obtained by open cutwork and hand sorting, operations can not be carried on to advantage in the winter months.

The newly discovered deposit near Keeseville, Essex co., noted in the report for 1905, has been under development, but made no output except a small quantity for experimental purposes. The recent work has shown the deposit to be of large extent. The garnet occurs in massive form, frequently more or less granulated and admixed with green pyroxene. It has been used experimentally in the manufacture of abrasive wheels, with results reported as very satisfactory. The property is owned by G. W. Smith of Keeseville.

The production reported by the companies for 1906 was the largest on record, amounting to 4729 short tons valued at $159,298. In the preceding year the total was 2700 tons valued at $94,500, and in 1904 it was 3045 tons valued at $104,325. The relatively small output for 1905 was due in part to a temporary curtailing of operations by the North River Garnet Co., incidental to starting their new plant.

## GRAPHITE

The production of crystalline graphite in the Adirondack region showed an unexpected falling off during the past year. It amounted to a total of 2,811,582 pounds valued at $96,084, as compared with 3,897,616 pounds valued at $142,948 in 1905 and 3,132,927 pounds valued at $119,509 in 1904. The output for 1905 was probably the largest that has been made in any one year since the establishment of the industry. The average value of the graphite per pound was 3.4 cents in 1906, 3.7 cents in 1905 and 3.8 cents in 1904, showing that there has been a decrease also in the market prices received for the product. The relatively small output in 1906 can not be ascribed to any general conditions that are likely to influence adversely the future progress of the industry, but is doubtless a temporary feature incidental to the limited scope of the operations as carried on at present.

The Adirondack graphite deposits which are being exploited are of the bedded type, the graphite occuring as disseminated flakes in a rock matrix, which may be limestone, quartzite or a silicious schist. The rocks are ancient sediments that have been thoroughly metamorphosed, and it is believed that the graphite has originated from included organic matter that was distilled by the heat to which they have been subjected, with a resultant loss of the volatile constituents. The rocks which have a thoroughly crystalline character, occur in force on the borders of the Adirondacks, but are less abundant in the interior. Their content in graphite is variable. As an extreme it may reach 8 or 10 per cent, which is found only in the deposits owned by the American Graphite Co., near Hague. The average for the other deposits that have been worked probably does not exceed 3 per cent.

The companies who have reported a production for 1906 are: American Graphite Co., with mines at Graphite, near Hague, Warren co.; Crown Point Graphite Co., operating near Penfield pond, Essex co.; Pettinos Bros., with mines at Rock pond, Essex co.; Adirondack Mining & Milling Co., and Champlain Graphite Co.,

with mines at South Bay, near Whitehall, Washington co. The plant of the Ticonderoga Graphite Co., at Rock pond, was leased to Pettinos Bros., of Bethlehem, Pa., who operated it for only a brief period. The graphite rock was found to be cut out by a fault. The Adirondack Mining & Milling Co. was active only for a period of three weeks, and will not resume operations during the present year.

The Glens Falls Graphite Co. has been incorporated for the purpose of working a graphite deposit situated near Conklingville, 8 miles west of Hadley, Saratoga co. The deposit is described as a quartzose schist with a thickness of 50 feet where opened. The erection of a mill is in progress, which it is expected will be completed early in the year.

The Empire Graphite Co. is engaged in developing a property near Greenfield, Saratoga co.

Some prospecting has been done in the vicinity of Graphite with a view to locating a possible extension of the bed worked by the American Graphite Co. Drill tests have indicated that the quartzite underlies a considerable area to the west of that company's property. In three holes which were put down the graphitic bed was found to be from 19 to 22 feet thick and was encountered at 50 to 75 feet depth.

## GYPSUM

The industries connected with the production of gypsum and its manufacture into commercial products have progressed rapidly during recent years. The advance has been due to the utilization of the material for wall plaster and plaster of paris, a branch of the industry that has been developed in New York State practically since 1900. Previous to that year the output of crude gypsum averaged less than 50,000 tons annually and was used almost wholly for agricultural purposes. Though the deposits of the State do not yield, as a rule, a material of high degree of purity, it has been found to be well adapted for making the usual grades of calcined plasters.

The quarries of gypsum are situated along a belt extending west from Madison county through Onondaga, Cayuga, Seneca, Ontario, Monroe, Genesee and Erie counties. The gypsum is found in one or more beds associated with the Camillus shale of the Salina group. The beds range up to 30 feet or more in thickness. They are worked only along the outcrop, generally by open pit methods, though underground mining is practised to some extent in the western

section. The manufacture of wall plaster is carried on principally in the vicinity of Syracuse, Onondaga co., at Wheatland and Garbutt, Monroe co., and at Oakfield, Genesee co.

The output of gypsum in crude form during 1906 amounted to 262,486 short tons, reported by 16 producers. In 1905 the output was 191,860 short tons and in 1904 it amounted to 151,455 tons. The greater part of the output was converted into wall plaster and plaster of paris, the combined product of these materials amounting to 163,451 short tons valued at $595,285 against 130,268 tons valued at $478,084 in the preceding year. The totals include only the quantities made from gypsum mined or quarried in the State; in addition there is a production of wall plaster and plaster of paris from imported material for which no returns are received. The quantity of gypsum that was ground and sold for land plaster amounted in 1906 to 20,656 short tons valued at $46,094, against 19,815 tons valued at $39,014 in the preceding year. A further portion amounting to 34,626 tons valued at $58,076 in 1906 and to 27,980 tons valued at $34,095 in the preceding year was sold in the crude state.

**Production of gypsum**

| | 1905 | | 1906 | |
|---|---|---|---|---|
| | Short tons | Value | Short tons | Value |
| Total output | 191 860 | ........ | 262 486 | ........ |
| Sold crude | 27 980 | $34 095 | 34 626 | $58 076 |
| Ground for land plaster | 19 815 | 39 014 | 20 656 | 46 094 |
| Wall plaster etc. made | 130 268 | 478 084 | 163 451 | 595 285 |
| Total value | ........ | $551 193 | ........ | $699 455 |

Unusual attention has been given during the past year to the exploration of the gypsum deposits of the State, with results that promise to contribute toward the further expansion of the industry in the immediate future. In Onondaga county a new company has been engaged in the development of a deposit near Jamesville. A vertical shaft was put down to a depth of 100 feet and encountered about 40 feet of gypsum at the bottom. The Lehigh Portland Cement Co. and E. B. Alvord & Co. were active in exploring for deposits in the same district. The American Gypsum Co. has developed a property near Alabama, Genesee co., where the Akron Gypsum Co. has also opened a deposit. The former company in-

tends to erect a calcining plant. The Monarch Plaster Co. began production for the first time in 1906 from its mine situated at Wheatland, Monroe co. Exploratory operations have been under way also near Leroy and Oakfield, Genesee co.

## IRON ORE

The revival of interest in iron ore mining noted in the preceding issue of this report has continued to exert a very favorable influence upon the industry of the State. A larger number of mines have been active during the past year than at any time since the memorable depression immediately following 1890 which brought about the abandonment of most of the local enterprises. The production, also, has shown a satisfactory gain, and with the increment that will be contributed by the new undertakings when they are under full headway, it should undergo still further expansion.

Altogether there were 11 companies engaged in mining operations. This number includes only those reporting a commercial production of ore. There were several other companies that had properties under exploration or development, and some of them will begin shipment during the current year.

The accompanying table gives the annual production of iron ore for the period of 1890–1906 inclusive. The statistics covering the years previous to 1904 are taken from the volumes of the *Mineral Resources* published by the United States Geological Survey, while those for 1904 and subsequent years have been collected at this office.

**Production of iron ore in New York State**

| YEAR | MAGNETITE | HEMATITE | LIMONITE | CARBONATE | TOTAL | Total value | Value per ton |
|---|---|---|---|---|---|---|---|
| | Long tons | Long tons | Long tons | Long tons | Long tons | | |
| 1890 | 945 071 | 196 035 | 30 968 | 81 319 | 1 253 393 | .......... | ..... |
| 1891 | 782 729 | 153 723 | 53 152 | 27 612 | 1 017 216 | .......... | ..... |
| 1892 | 648 564 | 124 800 | 53 694 | 64 041 | 891 099 | $2 379 267 | $2 67 |
| 1893 | 440 693 | 15 890 | 35 592 | 41 947 | 534 122 | 1 222 934 | 2 29 |
| 1894 | ........ | ........ | ........ | ........ | 242 759 | .......... | ..... |
| 1895 | 260 139 | 6 769 | 26 462 | 13 886 | 307 256 | 598 313 | 1 95 |
| 1896 | 346 015 | 10 789 | 12 288 | 16 385 | 385 477 | 780 932 | 2 03 |
| 1897 | 296 722 | 7 664 | 20 059 | 11 280 | 335 725 | 642 838 | 1 91 |
| 1898 | 155 551 | 6 400 | 14 000 | 4 900 | 179 951 | 350 999 | 1 95 |
| 1899 | 344 159 | 45 503 | 31 975 | 22 153 | 443 790 | 1 241 985 | 2 80 |
| 1900 | 345 714 | 44 467 | 44 891 | 6 413 | 441 485 | 1 103 817 | 2 50 |
| 1901 | 329 467 | 66 389 | 23 362 | 1 000 | 420 218 | 1 006 231 | 2 39 |
| 1902 | 451 570 | 91 075 | 12 676 | Nil | 555 321 | 1 362 987 | 2 45 |
| 1903 | 451 481 | 83 820 | 5 159 | Nil | 540 460 | 1 209 899 | 2 24 |
| 1904 | 559 575 | 54 128 | 5 000 | Nil | 619 103 | 1 328 894 | 2 15 |
| 1905 | 739 736 | 79 313 | 8 000 | Nil | 827 049 | 2 576 123 | 3 11 |
| 1906 | 717 365 | 187 002 | 1 000 | Nil | 905 367 | 3 393 609 | 3 75 |

The total shipments reported by the mines in 1906 amounted to 905,367 long tons valued at $3,393,609. Compared with the previous year this was an increase of 78,318 tons or about 9 per cent. The production was more than double that reported for 1901 and was the largest for any year since 1891.

Classified as to variety the shipments consisted of 717,365 tons of magnetite, 187,002 tons of hematite and 1000 tons of limonite. Of the magnetite 479,644 tons were marketed in the form of concentrates with an approximate content of 65 per cent iron. The 237,721 tons of lump magnetite included in the total are estimated to average 60 per cent. The hematite and limonite range from 40 to 60 per cent, with an average probably of 45 per cent.

The magnetite concentrates were made from 729,091 tons of crude ore. Using that figure for a basis of calculation, the total quantity of ore hoisted from New York mines in 1906 was 1,154,814 long tons. In 1905 the quantity was 1,109,385 long tons.

The magnetite was derived mainly from the Adirondack region. The producers included Witherbee, Sherman & Co. and the Port Henry Iron Ore Co. at Mineville; the Arnold Mining Co. at Arnold; and the Chateaugay Ore & Iron Co. at Lyon Mountain. The Salisbury Steel & Iron Co. made a small output in connection with the development of their mine at Salisbury. In southeastern New York the Hudson Iron Co., which took over the Forest of Dean mine in 1905, began shipments. It has been the only producer in that section.

Of the total quantity of hematite reported the mines in the Clinton formation contributed a little more than half. The Franklin Iron Manufacturing Co. and C. A. Borst at Clinton and the Furnaceville Iron Co. at Ontario operated the mines. The remainder of the hematite came from St Lawrence and Jefferson counties where the Rossie Iron Ore Co. and the Old Sterling Iron Co. were active.

The single producer of limonite was the Amenia Co. at Amenia, Dutchess co.

The Fair Haven Iron Ore Co. was engaged in developing its properties near Sterling Station, Cayuga co., but produced only small quantities for trial purposes. It will begin commercial shipments this year.

In the Adirondack region, the exploration of the titaniferous magnetites near Lake Sanford, Essex co., has attracted much attention. It has been known for many years that the ore bodies are of enormous extent, and the recent tests have confirmed and added to the previous estimates. The successful issue of the enterprise must depend of course upon the metallurgical factor, which has hitherto

deterred iron manufacturers from attempting to utilize the ore in blast furnaces. It is the purpose of the present company to carry out a thorough investigation with a view to finding a commercial outlet for the ore. Considerable quantities of the ore have been mined and shipped for experiment to furnaces and to the magnetite concentrators at Mineville.

The Cheever mine near Port Henry, Essex co., is to be reopened. The mine which has been closed down for about 15 years has been equipped with pumps for unwatering the underground workings. It is planned to erect a concentrator during the present season.

The Benson mines in St Lawrence county have been taken over by new parties who will begin mining operations during the current year. It is intended at the start to use the old mill, after the necessary improvements have been made, but a new one will be erected if warranted by the developments.

The Hammondville district in Essex county has been under exploration by the Oliver Iron Mining Co. A magnetic survey was carried out, and the ground further tested by the diamond drill. The results have shown the existence of ore bodies hitherto unworked, but the reserves thus far found have not been sufficient to warrant a renewal of mining operations.

## Notes on recent mining developments

**Mineville.** The production from this district was curtailed to some extent by a temporary suspension of operations on the part of the Port Henry Iron Ore Co. A slide of rock and earth last spring partly filled the large open pit in mine "21" and prevented access underground through the inclined shaft at the bottom. The shaft was retimbered and restored, but no ore was taken out for several months. Work in the pit has been discontinued. The company has started a new shaft in order to forestall any further trouble from similar sources. It is located 500 feet south of the present one and east of the Bonanza shaft of Witherbee, Sherman & Co. which is on the same ore body.

Mining was continued by Witherbee, Sherman & Co. in the five shafts worked during the preceding year, comprising the Joker and Bonanza on the Old Bed, A and B shafts on the Harmony ore body and Cook shaft. The two mills for treating the ore have likewise been in commission. Exploration work has been prosecuted by the company with little interruption, and the available ore supplies are well ahead of the production. The results obtained by diamond

drilling on the Old Bed have been particularly favorable. The extension of the deposit to the south has been practically established for a distance of several hundred feet beyond the present limits of the workings. With the enormous development shown by the ore body in cross-section, every foot added to its longitudinal extent means an important addition to the ore reserves.

The construction of a new power plant was begun by Witherbee, Sherman & Co. during 1906. The building is situated on the lake side at Port Henry, and is constructed of concrete made of cement and mill tailings. It will supply 800 kw. A 6 mile transmission line will connect the plant with the mines. This increment to the power supply will enable the company to enlarge considerably its mining operations.

**Lyon Mountain.** The mines were continuously active during 1906 and their output has been larger than for several years past. The increase has been made possible by the erection of a new mill which has doubled the former capacity for concentrating the ore and which was placed in operation for the first time during the summer. Other additions to the plant have been in course of construction, including the installation of a central power station, air compressors, new trackage, and houses for the miners.

The new mill was designed for the treatment of 1200 tons crude ore a day or 50 tons an hour. The results thus far obtained show that under normal conditions it is capable of a considerable larger output. It also effects an important saving in the item of labor. The concentrates turned out run about 63 per cent iron. In the old mill about 6 per cent of iron was lost in the tailings, while now the latter carry only 4 per cent as an average.[1]

The central power station when completed will have a capacity of 3000 h.p. It is to replace the small power plants that are distributed among the different shafts and the old separator. The first third of the station developing 1000 h.p. has been completed and put in operation. It supplies power to the new mill through a 500 kw. generator directly connected to a Curtis turbine. In the same room is installed a cross-compound two stage air compressor for furnishing air to the drills.

As described in the issue of the bulletin for 1905, the mines at Lyon Mountain are very extensive. The ore bodies form a practically continuous belt from 5 to 6 miles long. Mining at present is

1 Consult article by D. H. Newland and N. V. Hansell, in Eng. & Min. Jour., Nov. 10 and 17, 1906.

confined to the central part of the belt for a distance of about 2000 feet along the outcrop. There are three parallel veins in this part. The principal underground workings are the Hall slope and the adjacent nos. 3, 4 and 5 slopes situated on the front vein. The greatest depth reached is about 1400 feet on the incline, or 800 feet vertically. In the bottom of the Hall slope the horizontal drifts are about 200 feet wide. On the back vein the Burden and Cannon open pits, southeast of the slopes named, have continued to furnish a large quantity of ore.

The furnace of the Northern Iron Co., located at Standish near Lyon Mountain, is run on concentrates from these mines, the product being low phosphorus pig iron that finds a special market. Shipments of concentrates are also made to Pennsylvania furnaces.

**Arnold hill.** The Arnold Mining Co. closed down its mines and mill during the summer. Though the ore resources can not be regarded as exhausted, it was found difficult to maintain the production at a rate that would supply the mill for continuous running. The ore body that has been mined is irregular and showed evidences of pinching out in depth. There are several other deposits on Arnold hill, as well as on the adjacent hill to the east, from which an adequate output for the mill might be derived if properly developed.

**Cheever mine.** It is expected to begin ore shipments once more from this mine during the present year. The property has been inactive since 1893. According to the plans drawn up by Mr O. S. Presbrey, the owner, the Weldon shaft on the south end of the ore outcrop will be first reopened. There is known to be a quantity of ore still unworked in this section. A mill will be erected near the shaft for concentrating the leaner magnetite that has been stocked on the surface from previous operations and of which much remains in the mine. The ore previously shipped consisted entirely of lump material running 60 per cent or over in iron.

The Cheever mine is situated about 2 miles north of Port Henry close to the shore of Lake Champlain. It is based on a series of deposits that can be traced along the strike for nearly a mile. For a few hundred feet from the outcrop the ore dips sharply to the west or southwest, but then continues nearly horizontal, slightly rising in places, toward the ridge of gabbro which cuts it off on the west. It is frequently faulted and intersected by dikes. The old workings are said to cover an area of 40 acres. The deposits range up to 20 feet thick.

The ore in appearance and composition is much like that from the Mineville deposits. It is, however, lower in phosphorus than the Old Bed product, with an iron content of from 63 to 65 per cent. The shipments are reported by Smock to have amounted in all to 800,000 tons.

**Lake Sanford.** The property formerly owned by the McIntyre Iron Co., comprising over 100 square miles in western Essex county within which the Lake Sanford titaniferous magnetite deposits are located, has been taken over by parties for the purpose of exploration and development. The new company has been organized by Mr W. T. Foote, who is actively identified with its management. It is to be known as the Tahawus Iron Ore Co. Exploratory work has been under way throughout the past year.

The Lake Sanford ore bodies are the largest of their kind in the Adirondacks and undoubtedly rank among the largest deposits of iron ore in the entire country. They were first made known to the public through the descriptions of Professor Emmons in his reports on the Survey of the Second Geological District. They have since been investigated by Prof. J. F. Kemp,[1] who has given a very full account of their geology as well as of their mineralogical and chemical characters.

The diamond drill tests made during the past year have demonstrated that the ore bodies, which have hitherto been known only from outcrop, extend to considerable depths and that there are enormous resources of ore available for easy extraction. On the Sanford deposit the drills have shown as much as 360 feet of ore, and they have nowhere passed into the foot wall. This ore body was prospected by Professor Emmons who, as a result of his observations which have been recorded with much detail, estimated that it contained over 6,000,000 tons of ore within a distance of 2 feet below the adjoining surface. The bounds of the deposit as known to him have been greatly extended by subsequent investigations.

The ore from this locality is a coarse titaniferous magnetite. It is nearly free from admixed minerals of the wall rock, except on the borders where more or less feldspar and pyroxene are present. The deposit is well situated for working, as it outcrops along the sides and crest of a hill which rises about 300 feet above the shore of Lake Sanford. Quarry methods can be used here to advantage.

The recent exploration has disclosed the existence of an area of ore-bearing ground north and west of Calamity brook, near the

1 Titaniferous Iron Ores of the Adirondacks. U. S. Geol. Sur. 19th An. Rep't, pt III.

outlet of Lake Henderson. The tract lies without the limits of the deposits that have been previously described. Though much of the ore is mixed with rock there are large bodies of practically solid magnetite of a quality not inferior to the Sanford ore. The following is a record of one of the drill holes.

| | Feet | Inches |
|---|---|---|
| Lean ore, consisting of disseminated magnetite with feldspar and pyroxene | 19 | 3 |
| Rich ore | 30 | 6 |
| Rock and lean ore mixed | 15 | .. |
| Rich ore | 33 | 6 |
| Rock carrying some ore | 11 | 1 |
| Lean ore | 12 | .. |
| Rock and lean ore | 8 | .. |
| Rich ore alternating with rock | 10 | 7 |
| Rock | 5 | .. |
| | 144 | 11 |

The Cheney ore bed west of Lake Sanford and the several deposits between Lakes Sanford and Henderson are known to be extensive.

An interesting feature that has been brought out by recent experimentation with the ores is the possibility of reducing the titanium by mill treatment. It has been established that in some cases at least this element is not uniformly distributed in chemical combination with the iron, as has been advanced by some writers. By crushing the ore to fine size and passing over magnets, a process like that used in the concentration of nontitaniferous magnetites, it is found that a separation can be made into a strongly magnetic portion and a residuum that is very weakly magnetic. The magnetic material shows on analysis a smaller content of titanium than the average of the ore used in the experiment, the content decreasing with the fineness to which the ore has been crushed. The weakly magnetic portion, which passes into the tailings, contains on the other hand an increased proportion of this element. The experiments seem to prove beyond all doubt that in such cases the ore consists of a mechanical mixture of two minerals, one of which is magnetite, with only a small amount of titanium, and the other a titanium-bearing iron oxid that is probably ilmenite. With the Sanford ore, it has been found that the titanium can be brought down to a limit where the utilization of the concentrates in the blast

furnace appears to be practicable. It may be pointed out that practically all of the so called nontitaniferous magnetites of the Adirondacks, as probably elsewhere, carry titanium, though the amount, of course, is small, usually less than 1 per cent.

Besides the possibility of concentration, it is not unlikely that a portion of the titaniferous ore can be used in crude state. Analyses show that the titanium is extremely variable. Some ores from the district contain only about 5 or 6 per cent, so that by mixing with ores free from titanium the percentage could be reduced to a fraction of that amount. The open-hearth process of steel making furnishes another possible outlet.

The Lake Sanford deposits are situated in the interior of the Adirondacks, on the slopes of the rugged mountain group centering around Mt Marcy. Their elevation of outcrop averages about 2000 feet above sea level. The nearest railroad point is North Creek, about 30 miles distant. The problem of transportation is thus a critical one; the construction of a branch railroad is now under consideration.

**Forest of Dean.** The Hudson Iron Co. began active mining at this locality during 1906. The company took over the mine in October 1905, but as the work of unwatering and reequipping extended over several months, no shipments were made until the following summer.

The Forest of Dean mine is situated 5 miles west of Fort Montgomery, Orange co. It has the longest record as a producer, probably, of any mine in the country that is now under operation. According to Beck it was worked as early as 1756. In the period from 1865 to 1894, when it was under the ownership of the Forest of Dean Iron Ore Co., the production amounted to over 500,000 tons.

The ore body consists of an immense shoot that is apparently folded upon itself into a synclinal, the two wings of which extend to the surface. The wall rock and ore dip steeply southeast, while the latter pitches to the northeast. The horse of gneiss separating the two wings of the fold wedges out with depth. Access to the underground workings is had through a slope driven on the foot wall. The slope has been carried to a distance of 1700 feet from the surface and a vertical depth of 700 feet.

The ore is a rich magnetite of non-Bessemer character. An analysis quoted from Smock's report shows the following percentages:

| | |
|---|---|
| Iron oxid ($Fe_2O_3$) | 83.56 |
| Silica ($SiO_2$) | 5.00 |
| Phosphoric anhydrid ($P_2O_5$) | 2.30 |

| | |
|---|---|
| Alumina ($Al_2O_3$) | tr |
| Manganous oxid (MnO) | .63 |
| Lime (CaO) | 5.51 |
| Magnesia (MgO) | 1.19 |
| Carbon dioxid ($CO_2$) | 1.05 |
| Water ($H_2O$) | .20 |
| | 99.44 |

The company owns a furnace at Secaucus, N. J., to which the ore is shipped. In order to reach the Hudson river, a tramroad 4 miles long has been built. At the terminal of the road the ore is loaded into the buckets of an aerial rope conveyor, 6300 feet long, which carries it to the dock at Fort Montgomery where there is a 1000-ton storage bin. The power for driving the air compressor and pump at the mine is taken from the adjacent Popolopen creek.

**Caledonia mine.** This mine situated in the hematite district of St Lawrence and Jefferson counties has been operated in recent years by the Rossie Iron Ore Co. It has furnished altogether probably 500,000 tons of ore. The record for the past year has been a very creditable one, the output having been more than double that for 1905, while large resources have been opened for future exploitation. The company has recently enlarged and improved its surface plant which will enable it to increase the production still further.

The ore is a fairly rich soft hematite, running from 50 to over 60 per cent in iron. Its quality seems to improve somewhat with the progress of mining in depth.

It carries a relatively high proportion of lime which with its excellent physical character makes it very adaptable to furnace treatment. A rough sorting is required to remove admixed rock, and about one fourth of the material hoisted is thus rejected at the surface. An analysis[1] of shipping ore shows the following chemical constituents:

| | |
|---|---|
| Iron (Fe) | 52.71 |
| Silica ($SiO_2$) | 10.12 |
| Alumina ($Al_2O_3$) | 7.04 |
| Manganous oxid (MnO) | 1.69 |
| Lime (CaO) | 7.04 |
| Magnesia (MgO) | 0.38 |
| Carbon dioxid ($CO_2$) | 5.41 |
| Sulfur (S) | .03 |

1 *See* article by Robert B. Brinsmade, Eng. & Min. Jour. Sept. 15, 1906.

From an average of several determinations, the phosphorus may be placed at about .5 per cent.

The ore occurrence furnishes an interesting example of the replacement type of deposits. The associated rocks are crystalline limestone and schists of Precambric (Grenville) age and Potsdam sandstone. The Precambrics have a northeasterly strike and a variable dip generally to the southeast. They are overlain by the sandstone with a marked erosional unconformity at the base. The dip and strike of the sandstone are subject to rapid changes from place to place, though it usually lies more nearly horizontal than the other formations.

The limestone and schist form an interbedded series that is seemingly conformable. Alternating belts of the two rocks occur across the strike, the repetition being due probably to successive folds with northeast-southwest axes. The schist is a quartzose graphitic variety, finely laminated as a rule. It doubtless represents an original silicious shale that contained considerable carbonaceous matter. Secondary alteration, apparently connected with the process of ore formation, has resulted in the development of chlorite from the silicates, forming a chlorite schist. This is locally called serpentine, but there is very little true serpentine present, so far as observed. The chlorite schist is always closely associated with the ore.

In many places the sandstone capping is notably altered at the base. It is decomposed to a soft iron-stained material, at times carrying a fairly large percentage of hematite and grading into the ore bodies below.

At the Caledonia mine the deposits follow the contact between a belt of limestone which constitutes the foot wall and an overlying belt of schist. They have a pronounced irregular often sinuous form, with bulges and pinches along the strike and dip. They frequently branch and run off for some distance into the hanging and foot walls. The limestone along the contact has been dissolved out to form deep cavities and these may be filled with ore. Horses of both limestone and schist are not infrequently encountered in the midst of the deposits. The workings do not appear to have penetrated anywhere the Potsdam, though it occurs on the hanging side within probably 100 feet of the edge of the limestone. Where seen on the surface above the workings it has a high dip to the east. The tilting has been due probably to settling of the surface owing to removal of the limestone by solution.

There are abundant evidences that the ore deposits have originated by a process of replacement. The cores of schist show gradation from the central unaltered nuclei outward into the rich hematite. Specimens of the ore may be found that still show the banding and cleavage characteristic of the schist. The presence of graphite, which would naturally be the most resistant of the minerals to solvent action, furnishes a clue to the origin of the ore even when all the other primary constituents have been removed. The relatively high percentages of silica and lime in the ore are likewise suggestive in that connection.

As to the source from which the ore has been derived, Prof. C. H. Smyth[1] jr has given an explanation that accords best with the geological phenomena surrounding the occurrence. Though based principally on observations made at the Old Sterling mine, the theory is equally applicable to the Caledonia ore body and in fact to all of the deposits in the district. Briefly stated, it ascribes the formation of the ore to the circulation of underground waters which have dissolved the iron-bearing minerals from the adjacent rocks and deposited their burden in the form of oxid and carbonate when they came in contact with the limestone. The source of the iron is to be traced to the presence of pyrite and magnetite in the schist. There are bands of schist impregnated with pyrite in the vicinity of the Caledonia mine, as well as at the Dickson and Old Sterling mines. These pyritic bands are developed on a large scale throughout the Grenville schists of St Lawrence county and have for a number of years been the object of mining. By oxidation, the iron would be brought into solution as ferrous and ferric sulfates. Free sulfuric acid would also result and would react upon the veins and disseminations of magnetite in the schist. On coming in contact with the limestone, the solutions would be decomposed, the iron being precipitated as carbonate or limonite, while at the same time the lime carbonate would pass into solution. By subsequent alteration the carbonate and limonite have been changed to hematite. Residual masses of unaltered carbonate are occasionally found in the Caledonia mine. The iron has been precipitated in part in the body of the schist, without the agency of limestone.

**Dickson mine.** The Old Sterling Iron Co. has recently reopened this property, which has been inoperative for several years. The mine is situated on the southwestern end of the belt in which

1 N. Y. State Mus. 47th An. Rep't, 1894. p. 692.

the Caledonia and Old Sterling deposits are located, about a mile from the latter. It was first worked in 1858.

The ore is an earthy hematite, occurring within graphitic schist. There is no limestone exposed in the workings and this rock does not appear to be present in the immediate vicinity. The deposits occupy zones of replacement following the bedding planes of the schist. The dip is to the northwest in an opposite direction to that at the Caledonia mine. The workings have reached a depth of 160 feet on the dip, and range from 10 to 40 feet wide.

Ore has been mined in the past from several pits between the Old Sterling and Dickson mines. There are good opportunities for exploration in the vicinity, as well as in the interval between the Old Sterling and the Caledonia mines. All of the deposits practically that are known have been located by surface outcrops. Their aggregate extent is small compared with the body of the schist, and it is not at all improbable that ore bodies may be found beneath the drift-covered areas. Tests with the dip needle show that the ore bodies have no appreciable magnetic properties, so that exploration would have to be carried on by costeaning or drilling. The thickness of the drift, judging from sections exposed in the district, is nowhere very great, probably less than 50 feet in most places.

## The Clinton hematite

BY C. A. HARTNAGEL

The Clinton ores occur as beds in the Clinton formation and extend for a distance of about 120 miles, from Herkimer county as far west as Monroe county. In the eastern section there are present two and some times three beds of ore. The lower oolitic bed is about 8 inches thick and is not at present worked, though in character it is very similar to the oolitic bed occurring 2 feet higher, which is the only one of the three beds now exploited. The lower politic bed is quite local in distribution and is definitely known only on the property of the Franklin Iron Manufacturing Co. The upper bed, locally known as "red flux," is found 24 feet higher. This bed is 5 feet thick and is strictly a fossil ore, consisting largely of bryozoan fragments and lacking oolites which are so characteristic of the lower beds. The analysis of the upper bed gives about 30% iron, which is too low to be profitably employed at present.

In the western section only one bed of ore is found. It here combines the character of the "red flux" and oolitic beds of the east-

ern section, in that it is made up partly of fossil fragments and partly of oolites. Its stratigraphic position in relation to the beds of the eastern section is not definitely known though it appears to be most closely related to the lower or oolitic beds.

The dip of the Clinton formation varies from 50 to 100 feet per mile and throughout its extent from Herkimer county to Monroe county contains one or more beds of ore. If only a single bed with an average thickness of 20 inches is used as a basis for calculation, the quantity of ore available in each mile of outcrop and an equal distance on the dip amounts in round figures to 5,000,000 long tons.

**Furnaceville Iron Co.** This company is engaged in mining ore near Ontario Center, Wayne co. The open cut method for mining the ore is here used to good advantage. The overlying soil and rock, 18 to 20 feet thick, are first loosened by blasting and then removed with steam shovels and revolving derricks. To loosen the soil and rock, holes extending downward through the capping and 3 inches into the ore are made with churn drills. The holes are 16 feet apart, the first row being drilled 6 feet from the edge of the trench. The loosened material is removed by steam shovels which drop the material into the buckets of the derricks which convey it to the spoil banks, opposite the long face of the trench and just beyond the edge of the ore which is being cleared of its overburden. Two sets of steam shovels and derricks, working in parallel and along the strike of the bed clear the ore for a width of 60 feet. A layer of limestone, 15 to 18 inches thick, remains on the ore which is not readily removed by the steam shovels. This is blasted away or removed by hand. The ore which is 22 inches thick is loosened by blasting. Steam drills are used and the holes are about 3 feet apart and 3 feet back from the edge of the ore. The drill holes extend about 3 inches into the underlying argillaceous limestone. A small amount of the latter comes off with the ore but it is readily removed. The ore is broken with hammers into convenient size for handling. The ore is then loaded into buckets holding about 2½ tons. A derrick carries the buckets directly to the cars which stand on a branch track of the Rome, Watertown & Ogdensburg Railroad. The track is located on the edge of the trench on the side opposite the spoil bank, and is moved back whenever a new working face is established along the strike. About 16 buckets of ore are needed for a car of 80,000 pounds. The ore is shipped to Emporium, Pa.

**Wolcott.** The Clinton ore was formerly mined near Wolcott,

24 miles east of Ontario. A furnace was in operation there as early as 1824. It is no longer in operation, the last blast having been made in 1869. The ore for the furnace was obtained in township 41, near Black creek, about 4 miles east from the furnace. The overburden is said to consist of 20 feet of soil and rock, the ore being 30 inches thick. The section is no longer accessible for measurement. A small amount of ore was also obtained just below the furnace along Wolcott creek. At present the ore shows a thickness of 14 inches, but as it lies immediately beneath surface soil, it undoubtedly represents but a part of the thickness of the original ore bed.

**Fair Haven Iron Co.** Ten miles northeast from Wolcott, the Fair Haven Iron Co. has recently begun to take out ore by the open cut method. The holdings of the company consist of 280 acres located at Sterling Station, Cayuga co. The opening for the ore is 400 yards southwest of the station and adjacent to the railroad tracks. The operations are conducted on the opposite side of the railroad from the old workings of the Furnaceville Iron Co. A siding from the railroad leads directly to the workings. The equipment of the company consists of one 60-ton Marion steam shovel, one 15-ton locomotive crane, two derricks, one 30-h.p. boiler, etc.

The company is at present engaged in excavating a trench along the strike of the ore. No large amount of ore has been taken out, but the company will begin shipping during the current year.

**Clinton.** All the operations now carried on at Clinton for the production of ore are by drifting. The open-cut method was abandoned principally because of the increasing thickness of the overburden.

The mining operations at Clinton are at present carried on by the Franklin Iron Manufacturing Co. and Mr C. A. Borst. The former company operates what were formerly known as the Franklin and Clinton mines. The operations of Mr Borst are carried on a short distance farther north at the two beds known as the Elliott and the Butler.

At both of the mines at Clinton the long wall method of working is used. Briefly this plan consists of a main gangway with branches so arranged that a space of 50 feet can be worked on each side of them. In mining, the working face is kept a short distance ahead of the gangway. When a working face is established the ore is obtained by drilling diagonally from the top of the bed. Upon blasting, the front and lower portion of the ore is thrown out. The ore is

trimmed in the mine and loaded into the mine cars. The remaining ore and enough of the overlying shale is then removed by drilling horizontally and blasting, so as to give sufficient hight for the miners to work.

The ore varies from 30 to 36 inches in these mines so that about 18 to 24 inches of shale is removed. The waste from the ore and all the shale removed goes into the gob. The roof is further secured by timbering. The posts are placed parallel to the working face and from 5 to 10 feet apart depending upon the nature of the roof.

The ore is hauled from the mine workings on cars. In the Franklin Iron Manufacturing Co.'s mines the cars are drawn by mules. In the Borst mine, steel cars with roller bearings are used; the grade in the mine is so slight that they can be operated by hand. In this mine steel rails connected by fish plates are used. The track rests directly on the rock so that in reality it serves as a portable railway. In the Franklin mines ventilation is made more perfect by means of a central air shaft.

The product of the Borst mines goes principally to paint manufacturers. The ore from the Franklin mines is smelted at the company's furnace at Franklin Springs about 2 miles south from the mines.

## MILLSTONES

Millstones are obtained in Ulster county. The industry is a small one, but it has been established for more than a century and still furnishes most of the millstones made in this country. The product is known as Esopus stone, Esopus being the early name for Kingston, once the principal point of shipment.

The millstones are quarried from the Shawangunk grit, a light gray quartz conglomerate found along the Shawangunk mountain from near High Falls southwest toward the Pennsylvania border. The Cacalico stone obtained in Lancaster county, Pa., and the Brush mountain stone, found in Montgomery county, Va., are of similar character. In Ulster county the grit rests upon the eroded surface of gray Hudson River shales and is overlain by red shale. It has generally been correlated with the Oneida conglomerate of central New York, though recent investigations have shown that it belongs higher up in the series, namely in the Salina. Its thickness ranges from 50 to 200 feet.

The grit is composed of quartz pebbles of milky color inclosed in a silicious matrix. The pebbles are more or less rounded and vary from a fraction of an inch up to 2 inches in diameter. The texture is an important factor in determining the value and particular use of the finished millstones.

The size of the stones marketed ranges from 15 to 90 inches. The greater demand is for the smaller and medium sizes, with diameters of 24, 30, 36, 42 and 48 inches. A pair of 30-inch millstones commonly sells for $15, while $50 may be paid for a single stone 60 inches in diameter. The largest sizes bring from $50 to $100. Besides the common type of millstones, disks are furnished which are employed in a roll type of crusher known as a chaser. The pavement of such crushers is also supplied by the quarrymen, in the form of blocks. Quartz, feldspar and barytes are commonly ground in chasers.

Most of the Ulster county quarries are situated along the northern edge of the Shawangunk mountain. Kyserike, St Josen, Granite and Kerhonkson are the principal centers of the industry while the distributing points include New Paltz and Kingston in addition to those named. The industry is carried on intermittently, many of the producers engaging in other occupations during a part of the year.

The market for millstones has been curtailed of late years by the introduction of rolls, ball mills and other improved forms of grinding machinery. The roller mill process has displaced the old type of cereal mills, particularly in grinding wheat. The small corn mills distributed throughout the southern states, however, still use millstones and furnish one of the important markets for the New York quarries. A part of the product is sold also to cement and talc manufacturers.

The production of millstones in 1906 amounted to a value of $22,442, or nearly the same as in the previous year when a valuation of $22,944 was reported. The production in 1904 was valued at $21,476.

## MINERAL PAINT

The term mineral paint is here used to designate the natural mineral colors obtained by grinding an ore or rock. The materials suitable for this purpose that are found in New York State include iron ore, shale, slate and ocher.

For metallic paint and mortar colors some form of iron ore, generally hematite or limonite, is commonly employed, but only a few localities are known where the ore possesses the requisite qualities of color and durability. The fossil hematite from the Clinton formation is perhaps most widely used in this country. The mines owned by C. A. Borst at Clinton, Oneida co., and those of the Furnaceville Iron Co. at Ontario, Wayne co., supply much of the crude material.

The red hematite mined by the Rossie Iron Ore Co. at Rossie, St Lawrence co., also yields a good metallic paint.

Mineral paint made from shale and slate is quite extensively used for wooden structures. When there is a considerable percentage of iron oxids present, the shale and slate may be sold for metallic paint. Their value depends largely upon the depth and durability of their color; but the degree of natural fineness and the amount of oil required in mixing must also be considered in determining their utility. At Randolph, Cattaraugus co., beds of green, brown and bluish shale occur in the Chemung formation. They are worked by the Elko Paint Co. In years past red shale has been obtained in Herkimer county from the Vernon beds at the base of the Salina. A similar material occurring in the Catskill series has been worked at Roxbury, Delaware co. The red slate of Washington county, which belongs in the Cambric, is also ground for paint. The Algonquin Red Slate Co. of Worcester, Mass., and A. J. Hurd of Eagle Bridge produce this material.

A product known as mineral black is made by grinding slate found in the Hudson River series.

The ferruginous clay called ocher occurs quite commonly in the State, but no deposits are exploited at present. A bed occurring on Crane mountain, Washington co., once supplied a considerable quantity.

Sienna, a variety of ocher, occurs near Whitehall. The deposit is a thin stratum in glacial drift and has been worked on a small scale.

In addition to the producers above mentioned, the Clinton Metallic Paint Co. of Clinton, and the William Connors Paint Manufacturing Co. of Troy, are engaged in the manufacture of mineral paints from New York materials.

The production of mineral paints in 1906 was as follows: metallic paint and mortar color 2714 short tons valued at $29,140; slate pigment 2045 short tons valued at $15,960. In the year 1905 the following quantities were reported: metallic paint and mortar color, 6059 short tons, valued at $70,090; slate pigment, 2929 short tons valued at $22,668. These quantities include only the output made within the State from local materials. A part of the crude material is shipped each year to points outside of the State for manufacture. An output of 9382 tons valued at $22,949 was reported by four firms who sell the crude ore or rock to paint grinders.

## NATURAL GAS

There are 15 counties in the State in which natural gas was produced for lighting and heating purposes during the past year. The principal supplies were derived from the fields in Allegany, Cattaraugus, Chautauqua and Erie counties, the aggregate value of their output being about 85% of that for the whole State. It is gratifying to note that the production reported from the different fields, with some exceptions, has been gradually increasing of late years. This is due in part, no doubt, to the greater care with which the supply is now conserved and utilized, as compared with the wasteful methods once used; but it would also appear that the natural resources are not in danger of rapid exhaustion.

The gas pools are found at several horizons in the geological column, ranging from the Potsdam sandstone in the Cambric to the Chemung and Portage shales and sandstones of the Devonic. As a rule there is a definite horizon for each field, though some wells have yielded gas at different depths and from various rock formations. The Trenton limestone seems to be the lowest of the prolific strata from which gas has been obtained in large quantity. It affords the main supply in the wells of Oswego and Onondaga counties. The Medina sandstone has come into prominence lately by reason of the large pools that have been found in it in Erie county, now the most productive of the State. The wells recently put down at Silver Creek, Chautauqua co., are also bottomed in the Medina. The Portage and Chemung strata yield most of the gas produced at other localities along the shore of Lake Erie in Chautauqua co., and practically the entire output of Cattaraugus and Allegany counties.

One of the leading developments of the past year has been the opening of a promising field at Pavilion, in the southeastern part of Genesee county. Five wells were drilled by the Pavilion Natural Gas Co., and are reported to have given indications of a flow amounting to over 2,000,000 cubic feet a day. They are located on the Starr and Hooker farms. It is intended to drill additional wells during the present year. The company furnishes gas to the village of Pavilion and has laid a pipe line to Leroy for the purpose of supplying that place. A second company was formed and secured leases within the village where it drilled four wells, of which all but one were dry. The gas is found at a depth of from 1700 to 1850 feet in what is believed to be the Medina sandstone. A bed of rock salt 84 feet thick was penetrated in well no. 2 of the Pavilion Natural Gas Co.

At Seneca Falls, Seneca co., a well drilled by H. W. Knight encountered gas at 1450 feet. It was continued to a depth of 1617 feet, giving a flow estimated at 20,000 cubic feet a day.

Several wells have been drilled for oil and gas in the vicinity of Dansville, Livingston co., during the past few years without any success. Further exploration has been undertaken at a locality about 4 miles south of the village, and has resulted in the discovery of a gas horizon at 1200 feet. It is intended to continue drilling to 2500 feet.

The Cherry Creek Oil Co. located a very successful well near Cherry Creek, in eastern Chautauqua county. The flow at the outset was above 500,000 cubic feet and has averaged about 150,000 cubic feet a day. The gas is used in Cherry Creek.

The Frost Gas Co. of Fredonia, Chautauqua co., and the Welch Gas Co. of Westfield in the same county are new producers. The wells owned by the former company are situated at Sheridan. The Welch Gas Co. drilled one well to a depth of 2355 feet when a pool was encountered which gave a measured flow of 235,000 cubic feet a day, afterwards settling down to 100,000 cubic feet. The horizon is said to be the white Medina sandstone. The well is located in Westfield and has been connected with the village mains. The company has a second well under way which had reached a depth of 2000 feet at the close of the year.

The gas field at Silver Creek, Chautauqua co., which was first opened in 1904, continues to be very productive. It supplies Dunkirk, Forestville and Silver Creek. The South Shore Gas Co. and the Silver Creek Gas & Improvement Co. handle the output.

In Steuben county the North Side Gas & Oil Co. has been engaged in exploration at Ferenbaugh, 4 miles north of Corning. A flow of about 25,000 cubic feet was struck in the first well at a depth of 250 feet. The company will continue operations. At Keuka a test well was put down on the farm owned by E. Newman, resulting in the discovery of small pockets at depths from 60 to 210 feet. Owing to an inrush of water the well has not been commercially productive. The Tusco Oil, Mineral & Gas Co., operating at Woodhull, reported the discovery of gas, though no attempt was made to utilize the flow.

Yates county reported an output of gas for the first time in 1906. The Rushville Mining & Gas Co. drilled two wells during the preceding year which supply the village of Rushville.

The occurrence of natural gas near Voorheesville, Albany co., may be recorded, though there has been no commercial production. A

well drilled for water opened a pocket in the Hudson River shales at 150 feet depth. The flow rapidly diminished.

**Production.** The value of the output of natural gas in 1906, as reported by the individual producers and pipe line companies, was $766,579. In 1905 the output was valued at $607,000 and in 1904 at $552,197. The gain for the year was thus about 26 per cent, while in the last years there has been an increase of nearly 50 per cent.

The quantity of gas produced in 1906 amounted to 3,007,086,000 cubic feet. In arriving at this total estimates are included for certain producers who were unable to supply exact figures, but, as it is only the smaller operators as a rule that do not keep records of their wells, the estimate is very close to the actual production. The quantity of gas yielded by the wells in 1905 is estimated at 2,639,-130,000 cubic feet, and in 1904 at 2,399,987,000 cubic feet.

**Production of natural gas**

| COUNTY | 1904 | 1905 | 1906 |
|---|---|---|---|
| Allegany-Cattaraugus | $183 830 | $204 430 | $247 208 |
| Chautauqua | 31 822 | 26 232 | 94 345 |
| Erie | 254 899 | 281 253 | 317 554 |
| *a* Livingston | 32 451 | 41 805 | 52 805 |
| Onondaga | 15 350 | 16 825 | 16 385 |
| Oswego | 14 990 | 13 583 | 13 182 |
| *b* Wyoming | 18 855 | 22 872 | 25 100 |
| Total | $552 197 | $607 000 | $766 579 |

*a* Includes also Seneca, Schuyler, Steuben, Ontario and Yates counties.
*b* Includes also Niagara and Genesee counties.

The average value of the natural gas as given in the returns ranges from a minimum of 18 cents to a maximum of 50 cents a thousand cubic feet. The general average for the whole State during the last three years has been about 25 cents.

The largest relative increase in production during the past year was shown by Chautauqua county, with a total valued at $94,345 against $26,232 in 1905. Erie county reported an output valued at $317,554 as compared with $281,253 in the preceding year. There was also a notable increase in the fields of Allegany and Cattaraugus counties.

## PEAT

The application of peat to industrial uses has continued to attract attention during 1906. As heretofore the main object in view has been to utilize the material for fuel purposes. The enterprises in New York State, however, have not been carried as yet beyond the experimental stage, and there were no plants making peat fuel on a commercial scale. A new feature of the subject that has come into prominence in the last year is the possibility of using peat for paper manufacture, a development suggested by recent work along this line that has been carried out in Europe.

The latest, as well as, perhaps, the most important experiments in the utilization of peat for fuel within the State has been started at Heuvelton, St Lawrence co. They are based on different principles than have heretofore been adopted for the purpose. The plant is installed on a boat, 125 feet long and 30 feet wide, which is self-propelling and carries all the machinery required for excavating the peat and converting it into marketable fuel. It is planned to operate on Black lake near Ogdensburg, where there are reported to be peat deposits at no great depths. The dredging apparatus consists of two conveyor chains that travel along inclined ways independently mounted and swinging so as to cover a width of 40 feet in front of the boat. The inclined ways can be raised or lowered as required, according to the depth from which it is necessary to dredge the peat. The latter is carried by the bucket chains into a hopper from which it is spouted to the first of the machines designed for its treatment, where it is mashed and kneaded. This machine breaks up the coarser material and at the same time expels a portion of the absorbed water. In the next process the peat undergoes a more thorough drying by heat. The drier resembles somewhat a horizontal water tube boiler and is made up of a large number of tubes arranged in tiers, the succeeding tubes of each tier sloping slightly in opposite directions. Steam is admitted around the tubes, while the peat is carried through them by special conveyors until it has made the entire circuit. After drying the peat is to be compressed into briquets or produced for use in gas producers. All the machinery is operated by electric power supplied by a boiler and engine that have been installed on the boat. The plant is built after the designs of Mr Walter T. Griffin who has also supervised its construction. It was not completed in time to be placed in operation before the close of the year.

The manufacture of peat into the heavier grades of paper, such as are employed in making cartons, boxes, etc., was commenced last

year by the Pilgrim Paper Co., who have erected a plant at Capac, Mich. It is reported that very satisfactory results have been obtained during the short period of activity. A subsidiary company has been incorporated for the purpose of establishing the industry in New York State and has acquired for that purpose a tract of peat land near Oswego. The special machinery requisite in using peat fiber is made after the Esser patents which are owned in Vienna, Austria. A small proportion of wood pulp in the form of screenings or of newspaper is incorporated with the fiber. The finished product has a strong, smooth texture and is quite resistant to dampness or moisture in contrast with paper made from ordinary materials. The peat found in the vicinity of Oswego is well adapted for this use, owing to its perfectly fibrous condition and freedom from foreign matter. A carload of peat was also shipped from Glens Falls to Michigan for experimental purposes.

## PETROLEUM

The petroleum industry of New York State shows few changes from year to year. There have been no important additions to the areas of the oil fields for some time, yet the output has been fairly well maintained as is evidenced by comparison of the annual totals which are included herewith. The stability of the industry may be ascribed largely to the fact that the oil pools when once tapped continue productive for a relatively long period. The increment from the new borings that are put down each year about counterbalances the decline in output from the old wells. At present the average daily yield of each well is less than one barrel. Pumping is generally resorted to and for this purpose gas engines, which are supplied from the natural gas that accompanies the petroleum, are used. From the storage tanks of the individual producers the oil is run into pipe lines for transport to the refineries. There are six pipe line companies operating in the State who handle practically all of the product.

The oil-bearing territory includes portions of Cattaraugus, Allegany and Steuben counties. It is the northernmost portion of the Appalachian field, which reaches its main development in the states of Pennsylvania, Ohio and West Virginia. The oil in the New York fields is associated with dark colored sandstones belonging to the Chemung formation of the Upper Devonic.

During the year 1906 a promising discovery of oil was made in the Short Tract district of northern Allegany county, where several

wells have been drilled within the last five or six years, but without establishing the existence of oil in quantity. The well was put down on the Van Nostrand farm, 5 miles from Fillmore. At a depth of 568 feet oil began to flow under natural pressure but soon subsided. A yield of about 10 barrels a day has been secured by pumping. The product is an amber oil of light specific gravity. Further drilling has been undertaken to test the importance of the discovery.

In the Bolivar district of southwestern Allegany county, a possible enlargement of the known productive limits is indicated by recent drilling at a locality 8 miles south of the village of Bolivar. Several wells were opened last year for gas, and one of them tapped an oil-bearing stratum at 1000 feet depth, yielding about five barrels a day.

The output of petroleum in New York State amounted in 1906 to 1,043,088 barrels of 42 gallons, as compared with 949,511 barrels in the preceding year. The estimated value of the yield was $1,721,-095, or an average of $1.65 per barrel. On the same basis the production in 1905 was valued at $1,566,931. In the compilation of the statistics for these years, as well as for 1904, the receipts of oil reported by the pipe line companies have been used. The list of companies is as follows: The Allegany Pipe Line Co., Columbia Pipe Line Co., Union Pipe Line Co., and Fords Brook Pipe Line Co., of Wellsville, and the Tide Water Pipe Co., Limited, of Bradford, Pa.

[a]Production of petroleum in New York

| YEAR | BARRELS | VALUE |
|---|---|---|
| 1891 | 1 585 030 | $1 061 970 |
| 1892 | 1 273 343 | 708 297 |
| 1893 | 1 031 391 | 660 000 |
| 1894 | 942 431 | 790 464 |
| 1895 | 912 948 | 1 240 468 |
| 1896 | 1 205 220 | 1 420 653 |
| 1897 | 1 279 155 | 1 005 736 |
| 1898 | 1 205 250 | 1 098 284 |
| 1899 | 1 320 909 | 1 708 926 |
| 1900 | 1 300 925 | 1 759 501 |
| 1901 | 1 206 618 | 1 460 008 |
| 1902 | 1 119 730 | 1 530 852 |
| 1903 | 1 162 978 | 1 849 135 |
| 1904 | 1 036 179 | 1 709 770 |
| 1905 | 949 511 | 1 566 931 |
| 1906 | 1 043 088 | 1 721 095 |

[a] The statistics for the years 1891–1903 inclusive are taken from the annual volumes of the *Mineral Resources*.

## PYRITE

There was a small output of pyrite from the St Lawrence county mines during the past year. The quantity reported was 11,798 long tons valued at $35,550, as compared with 10,100 long tons valued at $40,465 in 1905. The production was rather incidental to the preliminary work of development, than to regular mining.

The deposits in St Lawrence county have been under exploitation for several years, yet mining operations, hitherto, have had a desultory character without any stable or permanent basis. The main difficulty which seems to have prevented a successful issue of the various undertakings started in this field has been the lack of adequate capital to open the mines and equip them for large scale operations. The problem involved is very similar to that of magnetite mining in the Adirondacks.

The St Lawrence Pyrite Co., who took over the Stella mine at Hermon, has inaugurated the most extensive, as well as, perhaps, the most promising developments that have yet been undertaken. The company recently completed a 500 ton mill on the property and has been engaged during the year in opening the mines to supply an adequate output of ore. A railroad from the village of Hermon to Dekalb Junction has been built by the company and will enable it to ship the ore by car direct from the mill. There are five ore deposits on the property, of which two are being worked.

The Cole mine near Gouverneur, formerly owned by the Adirondack Pyrite Co., has been taken over by the American Pyrites Co. The mine has shipped in the past a considerable quantity of lump ore. It is equipped with a mill.

## QUARTZ

Westchester county has contributed a small output of quartz each year. The mineral is obtained from veins where it occurs nearly pure and also from pegmatite dikes in which it is mixed with feldspar. The product is used in part for pottery, being shipped to manufacturers of these articles at Trenton, N. J.; it is also employed in making wood filler and silicate paint. The Bridgeport Wood Finishing Co. of New Milford, Ct., and P. H. Kinkel of Bedford, N. Y., were the only producers during the past year.

## SALT

The salt production in the State has shown an increase of about 5 per cent for the past year. The total quantity of salt of all kinds mined or manufactured in 1906 as reported by the different companies, was 9,013,993 barrels of 280 pounds, on which a value of $2,131,650 was placed. The corresponding returns for 1905 aggregated 8,575,649 barrels with a valuation of $2,303,067 and those for 1904 amounted to 8,724,768 barrels with a value of $2,102,748. The output in 1906 exceeded the total reported for any previous year; the next largest production being that given for 1904.

The marketable grades of salt that are produced in New York include rock salt and the different varieties of brine salt known as coarse solar, common fine, table, dairy, agricultural and packers salt. In addition to the salt that is sold as such, a very large quantity is converted into soda products. The Solvay Process Co., at Solvay near Syracuse, manufactures such products directly from brine that is supplied by their own wells, and the amount of salt thus used is included in the statistics above reported.

The solar salt is made entirely in Onondaga county. Syracuse has long been the center of this branch of the industry which was first started in the vicinity in 1789. A natural brine with from 17 to 20 per cent sodium chlorid is employed. The brine is stored in glacial gravels and has evidently been formed by circulation of ground waters through adjacent beds of rock salt. Most of the wells are located on the Onondaga Reservation which is under State control. The brine is supplied to the individual evaporating plants at a fixed charge.

The manufacturers of brine salt at other localities in the State obtain their supplies from wells driven into the rock salt. Fresh water is introduced into the wells from the surface and pumped up after becoming nearly saturated. By this method a brine carrying about 25 per cent sodium chlorid may be secured, or within 1 per cent or so of the saturation point for water. The Tompkins county salt is thus obtained from depths exceeding 2000 feet.

Altogether there were 32 companies engaged in the production of salt in the State during the past year, as compared with 31 companies in 1905 and 30 in 1904. Of the total number, Onondaga county was represented by 21. The International Salt Co. operated four plants as follows: Ithaca works, Ithaca; Cayuga works, Myers; Glen works, Watkins; and Yorkshire works, Warsaw. The Hawley and Warsaw works at Warsaw owned by the company were inactive.

The Rock Glen Salt Co. has taken over the plant at Rock Glen, Wyoming co., once worked by the Kerr Salt Co.

The Sterling Salt Co. has opened a mine of rock salt at Cuylerville, Livingston co. The shaft was started in 1905 and was finished and equipped for hoisting in the latter part of 1906. It is bottomed at about 1100 feet in a bed of salt that averages 21 feet thick. It has a cross-section of 11 by 21 feet over all and is divided into two hoisting compartments and one ladderway. The equipment on the surface and underground is of the most approved type. The buildings, including shaft house, power houses and storage bins, are constructed of reinforced concrete. The output of the mine when under full headway will exceed 1000 tons a day. The first shipment was made in November.

The Retsof Mining Co. was a producer of rock salt from its shaft at Retsof, Livingston co., which for several years past has been the only active mine in the State. There are three salt shafts that are not now operated.

The accompanying tables show the production of salt distributed among the various grades as marketed. The output listed under "Other grades" is made up principally of rock salt and salt used for soda manufacture, but includes small quantities of other kinds not specified in the returns. The valuation placed upon this item, as will be noted, is much lower than that for the preceding grades.

Onondaga county ranks first among the counties of the State in quantity of output, due principally to the operations of the Solvay Process Co. Its production of marketable salt, however, is comparatively small. The relative rank of the counties according to their output of salt sold as such in 1906 was as follows, in the order of their importance: Livingston, Wyoming, Tompkins, Schuyler, Onondaga and Genesee.

The report of the superintendent of the Onondaga Salt Springs Reservation for the fiscal year ending September 1, 1906, states that a total of 1,817,113 bushels of salt was inspected, as compared with 1,654,448 bushels inspected during the preceding year. The increase was due to the favorable weather conditions which govern the solar salt industry. Some new wells have been put down during the year by the Onondaga Pipe Line Co. to supply manufacturers outside of the reservation. All of the salt made here is marketed through the Onondaga Coarse Salt Association.

**Production of salt by grades in 1905**

| GRADE | BARRELS | VALUE | VALUE PER BARREL |
|---|---|---|---|
| *a* Common fine | 1 355 843 | $486 371 | $ .36 |
| Common coarse | 238 149 | 93 567 | .39 |
| Table and dairy | 1 169 229 | 684 239 | .58 |
| Coarse solar | 453 206 | 173 729 | .38 |
| Packers | 37 792 | 14 477 | .38 |
| Other grades | 5 321 430 | 850 684 | .16 |
| Total | 8 575 649 | $2 303 067 | $ .27 |

*a* Includes some coarse solar salt, though the amount is not important.

**Production of salt by grades in 1906**

| GRADE | BARRELS | VALUE | VALUE PER BARREL |
|---|---|---|---|
| *a* Common fine | 1 164 064 | $413 462 | $ .35 |
| Common coarse | 182 636 | 62 758 | .34 |
| Table and dairy | 1 211 936 | 603 034 | .50 |
| Coarse solar | 510 800 | 191 551 | .38 |
| Packers | 39 286 | 14 100 | .36 |
| Other grades | 5 905 271 | 846 745 | .14 |
| Total | 9 013 993 | $2 131 650 | $ .23 |

*a* Includes some coarse solar salt, though the amount is not important.

## SAND-LIME BRICK

The manufacture of sand-lime brick is an industry that has been only recently introduced in New York State. The first plants were erected about three years ago. Reports have been received from seven companies that were in active operation during the whole or part of the year 1906, showing an output of 17,080,000 brick valued at $122,340. Two companies listed among the manufacturers failed to make any return as to their production, while one company was engaged in erecting a plant. The following companies comprise all, so far as known, that had plants completed or in course of erection at the close of 1906.

| NAME | LOCATION |
| --- | --- |
| Granite Brick Co. | Glens Falls |
| Lancaster Sand-Lime Brick Co. | Lancaster |
| Newburgh Sand-Lime Brick Co. | Newburgh |
| Paragon Plaster Co. | Syracuse |
| Rochester Composite Brick Co. | Rochester |
| Roseton Sand-Lime Brick Co. | Roseton |
| F. W. Rourke & Co. | Brooklyn |
| Sand Stone Brick Co. | Schenectady |
| Schenectady Brick Co. | Schenectady |
| Watertown Sand Brick Co. | Watertown |

## SLATE

Quarries of roofing slate are worked in Washington county near the Vermont state line. The productive district includes a narrow belt running nearly due north from Salem through the towns of Hebron, Granville, Hampton and Whitehall. Efforts have been made to work slate in other parts of the State, particularly in the Hudson river metamorphic region, but for reasons no longer apparent they have not led to the establishment of a permanent industry. Hoosick, Rensselaer co., New Lebanon, Columbia co., and New Hamburg, Dutchess co., are among the places that have furnished slate in the past. At the locality last named, beds were found which yielded large blocks resembling the Welsh slate in color and quality and adapted for structural material, billiard tables, blackboards and other purposes. They were operated as late as 1898.

The slate from Washington county exhibits a variety of colors. Red is the most valuable and is the characteristic product of the region. Owing to its rarity elsewhere, it has a wide sale and is in constant demand for export. This variety is found near Granville and in the Hatch Hill and North Granville districts between North Granville and Whitehall. Its occurrence is confined to areas of Lower Siluric age. Purple, variegated and different shades of green slate are produced from Cambric areas, principally around Middle Granville, Salem and Shushan. The unfading green which likewise commands a good price for roofing purposes, is quarried to some extent in Washington county, but the greater quantity comes from across the border in Vermont.

Up to the present time the production of slate for other than roofing purposes, such as mantels, billiard tables, floor tiling, blackboards, etc., has not been developed to any extent in this section. It is an important branch of the slate trade of Pennsylvania and Vermont, and there is no doubt that increased attention to this branch would greatly assist the advancement of the industry.

The output of slate in New York State last year amounted in value to $61,921, consisting of roofing slate $57,771 and mill stock $4150. The number of squares of roofing slate made was 16,248. In 1905 the output was valued at $95,009 and comprised 16,460 squares of roofing slate valued at $94,009 and $1000 mill stock. The average value of roofing slate for the year was $3.56 a square, against $5.71 a square in 1905. The smaller value last year was due to the relatively light production of red slate, as compared with the cheaper grades.

## STONE

The quarry products of New York State rank next in importance to clay manufactures. All of the principal varieties of building and ornamental stones are quarried and most of them on an extensive scale. The production, however, falls short of meeting the requirements for many kinds of stone. Large quantities of granite, marble and limestone are brought in from adjoining states or are imported from foreign countries. With the enormous undeveloped resources, there is abundant opportunity for development of the quarry industries to a scale more nearly commensurate with the market demands.

The statistics and notes incorporated in the following pages relate to the different quarry industries of the State, except those of slate, marl and millstones. Information regarding the slate and millstone industries will be found under their own titles, elsewhere in this report.

### Production of stone

The value of the quarry materials produced in 1906 amounted in the aggregate to $6,504,165. The total for the preceding year was $6,107,147, showing a gain of $397,018. The value of the limestone quarried was $2,963,829, against $2,411,456 in 1905. The sandstone was valued at $1,976,829, the greater part contributed by the companies engaged in the bluestone trade. In 1905 the sandstone amounted to a value of $2,043,960. The output of trap from the Hudson river Palisades, and Richmond and Saratoga counties was valued at $847,403, against $623,219 in the preceding year. Marble accounted for a value of $460,915, considerably less than the total reported for 1905 which was $774,557. There was little change in the granite industry, the value of the output amounting to $255,189 against $253,955 in 1905.

Classified as to uses, crushed stone was the largest item in the total, with an aggregate value of $2,435,493, an increase of more than $500,000 over the amount returned for 1905. The use of

crushed stone in road improvement and for making concrete has been the chief factor in the development of this branch of the industry which has about doubled in importance within the last two years. The quantity of crushed stone made last year was approximately 3,132,460 cubic yards, as compared with 2,762,774 cubic yards in 1905. The quantity reported as used for road metal was 905,750 cubic yards, against 1,080,034 cubic yards for the previous year. This total does not represent the full amount thus used, as many of the producers are unable to classify their product. The value of the building stone, rough and dressed, amounted to $1,408,583 in 1906, against $1,488,009 in 1905. Curb and flagstone aggre-

**Production of stone in 1904**

| VARIETY | BUILDING STONE | MONUMENTAL | CURBING AND FLAGGING | CRUSHED STONE | ALL OTHER | TOTAL VALUE |
|---|---|---|---|---|---|---|
| Granite | $89 300 | $11 262 | *a* | $83 295 | $38 025 | $221 882 |
| Limestone | 248 647 | .......... | $6 253 | 994 475 | 809 030 | 2 104 095 |
| Marble | 278 994 | 154 673 | *a* | *a* | 45 104 | 478 771 |
| Sandstone | 637 607 | .......... | 902 027 | 27 583 | 329 480 | 1 896 697 |
| Trap | *a* | .......... | .......... | 452 621 | 15 875 | 468 496 |
| Total | $1 254 548 | $165 935 | $908 280 | $1 557 974 | $1 237 504 | $5 169 941 |

*a* Included under "All other."

**Production of stone in 1905**

| VARIETY | BUILDING STONE | MONUMENTAL | CURBING AND FLAGGING | CRUSHED STONE | ALL OTHER | TOTAL VALUE |
|---|---|---|---|---|---|---|
| Granite | $139 414 | $10 431 | *a* | $69 748 | $34 362 | $253 955 |
| Limestone | 246 300 | .......... | $7 297 | 1 193 800 | 964 059 | 2 411 456 |
| Marble | 571 810 | 177 557 | *a* | *a* | 25 190 | 774 557 |
| Sandstone | 530 485 | .......... | 1 029 913 | 37 406 | 446 156 | 2 043 960 |
| Trap | *a* | .......... | .......... | 601 669 | 21 550 | 623 219 |
| Total | $1 488 009 | $187 988 | $1 037 210 | $1 902 623 | $1 491 317 | $6 107 147 |

*a* Included under "All other."

**Production of stone in 1906**

| VARIETY | BUILDING STONE | MONUMENTAL | CURBING AND FLAGGING | CRUSHED STONE | ALL OTHER | TOTAL VALUE |
|---|---|---|---|---|---|---|
| Granite | $231 190 | $4 119 | *a* | $13 980 | $5 900 | $255 189 |
| Limestone | 229 479 | .......... | $8 067 | 1 590 205 | 1 136 078 | 2 963 829 |
| Marble | 337 365 | 99 100 | *a* | *b* | 24 450 | 460 915 |
| Sandstone | 610 549 | *a* | 991 611 | 51 205 | 323 464 | 1 976 829 |
| Trap | *a* | .......... | .......... | 780 103 | 67 300 | 847 403 |
| Total | $1 408 583 | $103 219 | $999 678 | $2 435 493 | $1 557 192 | $6 504 165 |

*a* Included under "All other." *b* Included under Limestone.

gated the sum of $999,678, as compared with $1,037,210, represented almost entirely by bluestone. The monumental stone, principally marble, was valued at $103,219, against $187,988. The value of the stone quarried for purposes other than those given, including lime, furnace flux, paving blocks, riprap, rubble, etc., was $1,557,192 as compared with $1,491,317 in 1905.

## Granite

Under the head of granite are included the coarse crystalline rocks in which silicates are the predominant minerals. Besides granite in the true sense the group comprises such rocks as syenite, diorite, anorthosite and various kinds of gneisses, all of which are found in New York State and are commercially utilized for building or other purposes. The variety known as trap is, however, treated by itself.

The aggregate value of the products of the granite quarries in 1906 amounted to $255,189. Building stone was much the largest item in the total, with a valuation of $231,190. Among the other uses to which the product was put and the values of each were: monumental stone, $4119; crushed stone, $13,980; rubble and riprap $2423; paving blocks, curbing and miscellaneous, $3477. The quantity of crushed stone reported was 16,800 cubic yards. Westchester county alone made an output valued at $172,845, consisting principally of building stone. The remainder of the production was distributed among the following counties: Clinton, Fulton, Herkimer, Jefferson, Orange, Putnam and Warren. There were 19 quarries in all that were operated. In 1905 the value of the product was $253,955 of which Westchester county contributed $142,815.

Among the new developments during the past year was the opening of large quarries at Little Falls to supply crushed stone. The material used is syenite, similar to the Adirondack syenite occurrences of which the Little Falls mass is an outlier. The crushing plant erected by the Power & Mining Machinery Co. on the north side of the Mohawk river is the largest in the State, the capacity being 4000 cubic yards a day. The output will be used for road metal, railroad ballast and concrete. It is planned to erect a plant for making concrete brick from the screenings. The West Shore Stone Co. has opened quarries and erected a crushing plant on the south side of the river at Little Falls.

A quarry of monumental stone has been started near Ausable Forks, Clinton co. The material is a green syenite of attractive appearance.

**Production of granite**

| MATERIAL | 1904 | 1905 | 1906 |
| --- | --- | --- | --- |
| Building stone | $89 300 | $139 414 | $231 190 |
| Monumental | 11 262 | 10 431 | 4 119 |
| Crushed stone | 83 295 | 69 748 | 13 980 |
| Rubble, riprap | 30 760 | 30 125 | 2 423 |
| Other kinds | 7 265 | 4 237 | 3 477 |
| Total | $221 882 | $253 955 | $255 189 |

## Limestone

The limestone quarries are first in importance among the stone-working industries of the State. Compared with sandstone, which ranks second in value of output, limestone is not so extensively used as a building material, but it finds more extensive employment for road metal and concrete. Its wide occurrence, in connection with natural fitness for the purpose, has favored the development of a large crushed stone business that covers nearly every section of the State. The manufacture of lime also calls for a large part of the product.

The noncrystalline limestones, which alone are considered under this head, comprise a variety of rocks as regards their geological occurrence and physical and chemical characters. They are distributed among the Cambric, Lower Siluric, Siluric and Devonic systems. In chemical composition they include every gradation from practically pure lime carbonate to magnesian limestones and dolomites and to silicious, aluminous or ferruginous types in which the

**Production of limestone**

| MATERIAL | 1904 | 1905 | 1906 |
| --- | --- | --- | --- |
| Crushed stone | $994 475 | $1 193 800 | $1 590 205 |
| Lime made | 678 225 | 702 684 | 795 348 |
| Building stone | 248 647 | 246 300 | 229 479 |
| Furnace flux | 121 109 | 198 168 | 287 816 |
| Rubble, riprap | 22 230 | 40 664 | 32 975 |
| Flagging, curbing | 6 253 | 7 297 | 8 067 |
| Miscellaneous | 33 156 | 22 543 | 19 939 |
| Total | $2 104 095 | $2 411 456 | $2 963 829 |

carbonates play a subordinate rôle. Light colored and white limestones are not typical of the State, the prevailing colors being grayish or drab, and for this reason considerable quantities are brought in from other states, principally Ohio and Indiana.

The total output of limestone last year amounted in value to $2,963,829. This is exclusive of the products used in the Portland and natural cement industries, for which no statistics have been collected. Compared with the previous year, there was a gain of $552,-373 in the valuation, or about 23 per cent. The product was distributed among 33 counties of the State, with a total of over 160 quarries.

Crushed stone for road metal, concrete, etc., represents the largest item in the output. The value of this material was $1,590,205, against $1,193,800 for 1905. The manufacture of lime is second in importance with a product valued at $795,348 and $702,684 for the respective years. The building stone quarried amounted to a value of $229,479 against $246,300 in 1905; furnace flux to $287,816 against $198,168; rubble and riprap to $32,975 against $40,664; flagging and curbing to $8067, against $7297; and miscellaneous materials, not classified in the returns, to $19,939 against $22,543 in the preceding year.

Distributed according to the counties in which the limestone was quarried, the largest producer last year was Erie county which reported an output valued at $525,381, consisting principally of building stone, crushed stone and furnace flux. This county also ranked first on the list in 1905 with a valuation of $383,411. Onondaga county which returned a total value of $391,457 was second, the same position as in the preceding year when its output amounted to $310,322. It is the largest manufacturer of lime. The remaining counties which reported a value of over $100,000 each with their respective totals are here given, the figures in brackets being the corresponding totals for 1905: Dutchess, $368,927 [$234,578]; Rockland, $242,184 [$220,596]; Genesee, $227,062 [$227,087]; Warren, $205,832 [$192,136]; Westchester, $143,168 [$74,948]; and Albany, $106,800 [$101,425].

**Lime.** There were 38 firms that reported an output, last year, of limestone (including marble) for lime burning, either as a main product or in connection with the quarrying of other materials. The greater portion of the limestone was converted by the companies operating the quarries. In all 18 counties participated in the production. The quantity of lime made was 313,369 short tons, valued at $795,348. Onondaga county reported a product of 208,-

250 tons, or about 66 per cent. In the previous year the output amounted to 323,905 short tons, valued at $702,684, of which Onondaga county contributed 193,506 tons. The importance of the industry in this county is to be ascribed to the operations of the Solvay Process Co. which uses the lime as a reagent in the manufacture of soda products.

The production in the other leading counties for 1906 and 1905 respectively was as follows: Warren, 39,076 [38,025] tons; Clinton, 16,400 [16,000]; Washington, 12,000 [12,000]; and Lewis, 9500 [8557].

It will be noted that the value of the production as given above is considerably less than the ruling commercial price; this is due to the fact that a nominal valuation has been placed upon the portion used as a chemical reagent. Disregarding the quantities thus consumed, the value of the lime averaged $4.58 per short ton in 1906 and $3.58 in 1905.

**Crushed stone.** Limestone is more widely employed in New York State for crushing than any other kind of stone. The total production in 1906 amounted to 2,194,547 cubic yards valued at $1,590,205, as compared with 1,851,008 cubic yards valued at $1,193,800 in the preceding year. Of the quantities given, 486,750 cubic yards in 1906 and 573,924 cubic yards in 1905 were returned as having been used for road metal, though the actual amount thus used probably exceeded these totals since some plants do not keep any records as to the disposal of their product.

The leading counties in the production of crushed stone with their outputs are as follows, the figures for 1905 being bracketed: Dutchess, 400,177 [335,112] cubic yards; Rockland, 373,387 [335,714]; Genesee, 323,128 [288,000]; Erie, 289,110 [243,628]; Albany, 150,000 [131,000]; Westchester, 105,441 [43,926]; and Onondaga, 92,950 [84,811].

**Building stone.** The production of limestone for building purposes has remained comparatively steady during recent years. The value of the material quarried in 1906 was $229,479, against $246,300 in 1905. Erie county maintains the largest quarries of building stone, its output amounting to a value of $118,806 as compared with $103,763 in the preceding year. The remaining counties are small producers. The output each year is supplemented by large quantities of limestone that are brought in from other states.

**Furnace flux.** The metallurgical industries of the State consume limestone as a flux in smelting operations. The largest users are the iron blast furnaces located in Buffalo and vicinity. The

supply for this district is obtained from the outcrop of the Onondaga limestone in western New York and the adjacent part of the province of Ontario. The principal New York quarries are located at Clarence and Gunnville, Erie co., and at North Leroy, Genesee co. Flux is also obtained at West Chazy, Clinton co., and near Port Henry, Essex co., for use in the Adirondack iron furnaces, and at Oriskany Falls, Oneida co., for the iron furnace at Franklin Springs. The total production of limestone flux in 1906 amounted to 400,002 long tons valued at $229,479. In the preceding year the amount was 393,667 long tons, valued at $198,168.

**Production of limestone by counties in 1905**

| COUNTY | CRUSHED STONE | LIME MADE | FURNACE FLUX | BUILDING STONE | OTHER USES | TOTAL |
|---|---|---|---|---|---|---|
| Albany | $90 800 | $9 600 | ........ | $525 | $500 | $101 425 |
| Cayuga | 13 227 | ........ | $240 | 9 650 | 11 500 | 34 617 |
| Clinton | 4 600 | 58 000 | 5 200 | 9 105 | ....... | 76 905 |
| Dutchess | 234 578 | ........ | ........ | ........ | ....... | 234 578 |
| Erie | 153 736 | 497 | 96 626 | 103 763 | 28 789 | 383 411 |
| Fulton | 4 552 | 11 796 | ........ | ........ | ....... | 16 348 |
| Genesee | 127 000 | 13 260 | 81 516 | 2 211 | 3 100 | 227 087 |
| Herkimer | 5 412 | 5 913 | ........ | 30 | 1 020 | 12 375 |
| Jefferson | 3 951 | 43 000 | ........ | 6 154 | 4 650 | 57 755 |
| Lewis | 1 432 | 28 306 | ........ | 658 | 234 | 30 630 |
| Madison | 38 109 | ........ | ........ | 5 259 | 622 | 43 990 |
| Monroe | 37 404 | ........ | ........ | 8 036 | 351 | 45 791 |
| Montgomery | 60 385 | ........ | 115 | 7 216 | ....... | 67 716 |
| Niagara | 10 949 | 4 500 | ........ | 3 055 | ....... | 18 504 |
| Oneida | 17 243 | ........ | ........ | 1 500 | ....... | 18 743 |
| Onondaga | 39 832 | 234 308 | 5 550 | 17 984 | 12 648 | 310 322 |
| Rockland | 220 596 | ........ | ........ | ........ | ....... | 220 596 |
| St Lawrence | 940 | 9 650 | ........ | 2 249 | 3 185 | 16 024 |
| Saratoga | 8 500 | ........ | ........ | 3 065 | 205 | 11 770 |
| Schoharie | 17 246 | ........ | 50 | 49 227 | 272 | 66 795 |
| Seneca | 20 330 | 360 | 37 | 3 918 | 368 | 7 013 |
| Warren | 9 463 | 171 556 | ........ | 10 540 | 577 | 192 136 |
| Washington | 39 312 | 51 000 | ........ | 175 | ....... | 90 487 |
| Westchester | 30 748 | 43 900 | 300 | ........ | ....... | 74 948 |
| Other counties*a* | 21 455 | 17 038 | 8 534 | 1 980 | 2 483 | 51 490 |
| Total | $1 193 800 | $702 684 | $198 168 | $246 300 | $70 504 | $2 411 456 |

*a* Includes Columbia, Essex, Greene, Ontario, Orange, Orleans, Rensselaer, Schenectady, Ulster, Wayne and Yates.

**Production of limestone by counties in 1906**

| COUNTY | CRUSHED STONE | LIME MADE | FURNACE FLUX | BUILDING STONE | OTHER USES | TOTAL |
|---|---|---|---|---|---|---|
| Albany | $96 200 | $9 600 | ........ | $500 | $500 | $106 800 |
| Cayuga | 23 098 | ........ | $300 | 11 000 | 3 000 | 37 398 |
| Clinton | 8 350 | 61 500 | 15 900 | 7 175 | 4 000 | 96 925 |
| Dutchess | 368 927 | ........ | ........ | ........ | ....... | 368 927 |
| Erie | 222 384 | 375 | 172 550 | 118 806 | 11 266 | 525 381 |
| Fulton | 6 963 | 9 200 | ........ | ........ | ....... | 16 163 |
| Genesee | 142 342 | 14 000 | 69 650 | 1 070 | ....... | 227 062 |
| Greene | 1 785 | ........ | 186 | 24 500 | 15 500 | 41 971 |
| Herkimer | 4 000 | 6 300 | ........ | 810 | ....... | 11 110 |
| Jefferson | 4 875 | 42 250 | ........ | 6 053 | 499 | 53 677 |
| Lewis | 635 | 47 000 | ........ | 824 | 1 025 | 49 484 |
| Madison | 20 184 | ........ | ........ | 90 | 1 320 | 21 594 |
| Monroe | 52 295 | ........ | ........ | 7 564 | 547 | 60 406 |
| Montgomery | 55 235 | ........ | ........ | 4 116 | 1 297 | 60 648 |
| Niagara | 2 400 | 40 | ........ | 3 425 | 10 716 | 16 581 |
| Oneida | 32 000 | ........ | 12 600 | 15 000 | ....... | 59 600 |
| Onondaga | 63 986 | 313 500 | 3 420 | 8 976 | 1 575 | 391 457 |
| Rockland | 242 184 | ........ | ........ | ........ | ....... | 242 184 |
| St Lawrence | .......... | 9 040 | 3 311 | 800 | 911 | 14 062 |
| Saratoga | 13 000 | ........ | ........ | 3 000 | ....... | 16 000 |
| Schoharie | 21 073 | 300 | ........ | 10 825 | 7 875 | 40 073 |
| Seneca | 3 301 | 800 | 100 | 2 025 | 100 | 6 326 |
| Warren | 13 347 | 190 665 | ........ | 1 370 | 450 | 205 832 |
| Washington | 36 000 | 48 000 | ........ | ........ | 400 | 84 400 |
| Westchester | 105 441 | 36 766 | 711 | 250 | ....... | 143 168 |
| *a*Other co'nties | 50 200 | 6 012 | 9 088 | 1 300 | ....... | 66 600 |
| Total | $1 590 205 | $795 348 | $287 816 | $229 479 | $60 981 | $2 963 829 |

*a* Includes Columbia, Essex, Ontario, Orange, Rensselaer, Schenectady, Ulster, Wayne and Yates counties.

## Marble

The granular crystalline limestones and dolomites which are classed as marble occur in the Adirondack region and in the southeastern part of the State. They are mainly associated with metamorphosed Precambric strata. A few varieties of compact limestones, such as the Trenton limestone at Glens Falls and the Chazy limestone of Clinton county, possess ornamental qualities that fit them for special uses and are included under this head.

The quarrying of monumental marble is practically limited to the region about Gouverneur, St Lawrence co. The industry has been established here for many years, and the product has a wide sale. The marble varies from nearly white to dark bluish gray, the dark varieties being the more valuable. As only the best selected stone can be used for monumental work, the poorer grades are dressed into blocks for building and construction purposes.

In southeastern New York the quarries are worked mainly for building stone which is supplied to New York city and other markets in the east. White and gray marbles are the characteristic products. Greenport, Columbia co., South Dover, Dutchess co., and Ossining, Dobbs Ferry, White Plains, Oscawana, Pleasantville and Tuckahoe, Westchester co., are some of the quarry localities.

**Production of marble**

| VARIETY | 1904 | 1905 | 1906 |
|---|---|---|---|
| Building marble | $278 994 | $571 810 | $337 365 |
| Monumental | 154 673 | 177 557 | 99 100 |
| Other kinds | 45 104 | 25 190 | 24 450 |
| Total | $478 771 | $774 557 | $460 915 |

The production of marble reported by 13 producers amounted in 1906 to a value of $460,915, divided as follows: building marble, rough and dressed, $337,365; monumental marble, rough and dressed, $99,100; other kinds, $24,450. There was a large falling off in the production as compared with the preceding year when the output was valued at $774,557. This was due principally to the smaller demand for building stone in New York city. The value of the marble quarried in southeastern New York aggregated $260,350 against $464,247 in 1905. St Lawrence county reported an output valued at $136,835 against $265,722.

The quarries at South Dover formerly worked by the Dover Chemical & Quarry Co. have been taken over by the Exploitation Co. of America, with a view to reopening them to supply building stone. Development work was prosecuted during the past year and it is intended to begin shipments during the current season. Drill cores show that there is a large quantity of stone available, similar to the marble quarried by the South Dover Marble Co. which finds much favor as a building material. An analysis of the marble, made by E. F. Briggs, has been furnished by the present company and is here given.

| | |
|---|---|
| Lime (CaO) | 31.36 |
| Magnesia (MgO) | 19.41 |
| Carbon dioxid ($CO_2$) | 45.83 |
| Insoluble | 3.40 |
| | 100.00 |

## Sandstone

Under the head of sandstone are included the sedimentary rocks which consist of quartz grains bound together by some cementing substance. Among the principal varieties distinguished by textural characters are sandstones proper, conglomerates, grits and quartzites.

The wide distribution of sandstones in the geologic series of New York State has given them great importance as economical sources of structural materials and in point of annual output they rank second only to limestone. Nearly all of the main formations above the Archean contain these rocks at one or more horizons. The sandstones that are chiefly quarried in New York are the Potsdam, Hudson River, Medina, and the Devonic sandstones. A few quarries have been opened in the Shawangunk conglomerate and the Clinton sandstone. Bluestone is a popular term for the fine grained, evenly bedded sandstones found in the Devonic which have a special application for flagging and curbing and to a lesser extent for building stone.

### Production of sandstone

The total value of the sandstone quarried in New York last year was $1,976,829 as compared with $2,043,960, the value of the output in 1905. The output was distributed among 35 counties with an aggregate of over 400 producers. Classified as to uses the total was distributed as follows: building stone, rough, $343,077; building stone, dressed, $267,472; curbing, $553,085; flagging, $438,526; paving blocks, $282,063; crushed for roads, $14,677; crushed for other uses, $36,528; rubble, etc., $11,661; all other purposes, $29,740.

The following tables show the value of the production of sandstone in 1905 and 1906, distributed among the leading districts of the State.

Production of sandstone in 1905

| DISTRICT | BUILDING STONE | CURBING AND FLAGGING | PAVING BLOCKS | CRUSHED STONE | RUBBLE, RIPRAP | ALL OTHER |
|---|---|---|---|---|---|---|
| *Bluestone* | | | | | | |
| Hudson river... | $59 813 | $314 791 | $6 165 | ........ | ........ | $2 000 |
| Delaware river . | 64 084 | 441 634 | 2 500 | ........ | $4 400 | ........ |
| Chenango co... | 70 066 | 76 983 | 988 | ........ | 2 168 | 5 473 |
| Wyoming co... | 171 620 | 3 000 | ........ | ........ | 930 | 33 433 |
| Other districts.. | 36 210 | 59 641 | 587 | $1 102 | 374 | 11 282 |
| Total bluestone. | $401 793 | $896 049 | $10 240 | $1 102 | $7 872 | $52 188 |
| *Sandstone* | | | | | | |
| Orleans county. | $71 679 | $119 390 | $270 964 | $1 282 | $3 500 | $51 290 |
| Other districts.. | 57 013 | 14 474 | 29 565 | 35 022 | 16 345 | 4 192 |
| Total sandstone. | $128 692 | $133 864 | $300 529 | $36 304 | $19 845 | $55 482 |
| Combined total. | $530 485 | $1 029 913 | $310 769 | $37 406 | $27 717 | $107 670 |

Production of sandstone in 1906

| DISTRICT | BUILDING STONE | CURBING AND FLAGGING | PAVING BLOCKS | CRUSHED STONE | RUBBLE, RIPRAP | ALL OTHER |
|---|---|---|---|---|---|---|
| *Bluestone* | | | | | | |
| Hudson river... | $70 816 | $220 961 | $14 228 | ........ | ........ | ........ |
| Delaware river.. | 110 008 | 572 470 | 1 350 | 700 | 1 188 | ........ |
| Chenango co.... | 85 576 | 41 985 | ........ | ........ | 2 678 | ........ |
| Wyoming co... | 234 280 | .......... | ........ | 550 | 843 | 140 |
| Other districts.. | 12 658 | 4 247 | ........ | 2 770 | ........ | 325 |
| Total bluestone. | $513 338 | $839 663 | $15 578 | $4 020 | $4 709 | $465 |
| *Sandstone* | | | | | | |
| Orleans county. | $50 845 | $147 438 | $260 878 | $225 | $552 | $25 000 |
| Other districts.. | 46 366 | 4 510 | 5 607 | 46 960 | 6 400 | 4 275 |
| Total sandstone. | $97 211 | $151 948 | $266 485 | $47 185 | $6 952 | $29 275 |
| Combined total. | $610 549 | $991 611 | $282 063 | $51 205 | $11 661 | $29 740 |

The value of bluestone quarried for all purposes in 1906 was $1,377,773 or approximately 70 per cent of the total sandstone; the value of the other sandstone quarried was $599,056 or 30 per cent of the total. The returns show that there was a falling off in

the amount of sandstone quarried, due to a decrease of all grades produced except curbing and crushed stone. The amount of bluestone produced shows an increase. There was a falling off in the production of the Hudson river district but a gain is shown in the other bluestone districts.

The production of bluestone by districts was as follows: Hudson river, $306,005; Delaware river, $685,716; Wyoming county, $235,813; Chenango county, $130,239; other districts, $20,000. Of the sandstone quarried, Orleans county reported a production valued at $484,938 and other counties an output valued at $114,118. A more detailed classification of the product that would cover each county separately has been found impracticable, since many of the large companies which operate quarries at several localities are unable to divide their output according to the different sources. The relative rank of the principal counties of the State was, however, as follows in the order of their importance: Orleans, Delaware, Ulster, Wyoming, Sullivan, Chenango, Broome and St Lawrence.

The foregoing table shows that of the bluestone quarried along the Hudson river in Albany, Greene and Ulster counties, about 72 per cent was sold as flagstone and curbstone and about 23 per cent as building stone. In the Delaware river districts, including Sullivan, Delaware and Broome counties, the value of the flagstone and curbstone sold amounted to 83 per cent and the building stone to 16 per cent of the total. In Chenango county about two thirds of the entire product was marketed as building stone and the remaining one third as curbing and flagging. In Wyoming county, on the other hand, almost the entire product was marketed as building stone, the value of the other grades being less than 1 per cent of the total sales. The output of Medina sandstone in Orleans county was used chiefly for the following purposes: building stone, 10 per cent; curbing, 30 per cent; paving blocks, 54 per cent; other purposes, 6 per cent.

## Trap

The term trap is commonly applied to the dark fine grained rocks that occur in the form of dikes. In New York State the trap is usually a diabase, a rock composed essentially of plagioclase feldspar and pyroxene, with a massive compact texture. It is very common in the Adirondacks, specially along the Champlain valley in Clinton, Essex and Washington counties. There are numerous occurrences, also, in the region of crystalline rocks in southeastern New York, the largest being the intrusion which borders the west shore of the Hudson river southward from Haverstraw and is known

as the Palisades. The southern end of this intrusion is found in Staten Island, where it extends southwest from Port Richmond.

The principal use of trap is for crushed stone for roadmaking and concrete. It possesses qualities of strength and durability which place it first among the varieties of stone used for these purposes. The sombre color and the difficulty of dressing trap limits its employment in building work. It is used to some extent for paving blocks.

Rockland county produces most of the trap at the present time. The principal quarries are those at Rockland Lake operated by the Clinton Point Stone Co., and the Rockland Lake Trap Rock Co., those at Mt Joy worked by H. M. Gurnee, the Haverstraw quarries worked by the Haverstraw Trap Rock Co. and the Long Clove Trap Rock Co., and the quarries at Nyack operated by the Manhattan Trap Rock Co. The output of the county in 1906 amounted in value to $780,703.

In Richmond county the Quinroy Construction Co. operates quarries at Port Richmond.

The Saratoga Trap Rock Co. has opened a quarry in the town of Greenfield, 2 miles north of Saratoga Springs, where a dike about 200 feet wide is exposed. This is one of the largest of the Adirondack dikes. At Northumberland in the eastern part of Saratoga county, the Champlain Stone & Sand Co. has begun operations on a partially serpentinized diabase.

The production of trap in New York last year was valued at $847,403, as compared with a value of $623,219 reported for 1905, and $468,496, the value of the output in 1904. Crushed stone was the principal item in the totals, aggregating 851,293 cubic yards valued at $780,103 in 1906, against 774,111 cubic yards valued at $601,669 and 610,285 cubic yards valued at $452,621 in the two preceding years respectively. The greater part of the crushed stone was sold for road material, though the quantities thus used can not be accurately stated.

**Production of trap**

| MATERIAL | 1905 | | 1906 | |
|---|---|---|---|---|
| | Cubic yards | Value | Cubic yards | Value |
| Crushed stone | 774 111 | $601 669 | 851 293 | $780 103 |
| Paving blocks etc | ........ | 21 550 | ........ | 67 300 |
| Total | ........ | $623 219 | ........ | $847 403 |

## TALC

The St Lawrence county mines reported an output in 1906 of 64,200 short tons valued at $541,600. The yield was somewhat less than in the preceding year, when the total was 67,000 short tons, but the value showed a notable increase due to the higher range of prices. The average selling price for the year on the basis of carload lots was $8.43 a ton, as compared with $7.75 a ton in 1905. The following table gives the annual production and value by years for the period 1896–1906, the figures previous to 1904 being taken from the volumes of the *Mineral Resources*.

**Production of talc in New York**

| YEAR | SHORT TONS | VALUE | VALUE PER TON |
|---|---|---|---|
| 1896 | 46 089 | $399 443 | $8 67 |
| 1897 | 57 009 | 396 936 | 6 96 |
| 1898 | 54 356 | 411 430 | 7 57 |
| 1899 | 54 655 | 438 150 | 8 02 |
| 1900 | 63 500 | 499 500 | 7 87 |
| 1901 | 62 200 | 483 600 | 6 99 |
| 1902 | 71 100 | 615 350 | 8 65 |
| 1903 | 60 230 | 421 600 | 7 .. |
| 1904 | 65 000 | 455 000 | 7 .. |
| 1905 | 67 000 | 519 250 | 7 75 |
| 1906 | 64 200 | 541 600 | 8 43 |

A further consolidation of the mining and milling interests in the talc district was effected during the year by the International Pulp Co., the largest of the producers. Since its organization in 1893 the company has exercised a controlling influence over the industry, though it has not been without active competition from rival concerns. At the time it was formed the properties of the St Lawrence Pulp Co., the Natural Dam Pulp Co., the Agalite Fibre Co. and Adirondack Pulp Co. were acquired and in the following year those of the Asbestos Pulp Co. were also secured. The company thus came into possession of all of the then active interests except the United States Talc Co., which was taken over in August 1906. The latter owned a mine west of Talcville and a mill near Dodgeville. The mill has been recently enlarged by the addition of two cylinders and will restore partially the impairment of productive facilities with which the International Co. met during the past year in loss by fire of its Hailesboro mill. This mill was the

largest and perhaps the best equipped of any in the district. It had a capacity of 75 tons a day. The company also owns three other mills situated at Talcville near its mines.

The Union Talc Co. and the Ontario Talc Co. have been the only producers in recent years aside from those mentioned. It has been reported that both companies have also come under the control of the International Pulp Co. through recent purchase of the capital stock. The Ontario Talc Co. owns three mines and a mill near Fullerville in the central part of the district. The Union Talc Co. has been the largest independent operator since 1900. It was organized as a consolidation of the Columbian Talc Co., American Pulp Co. and Keller Bros., and came into possession of three mines and an equal number of mills. The American mill near Fowler was burned down in December 1905.

A new company was incorporated late in the year for the purpose of mining and manufacture of talc in the St Lawrence county district. According to present plans, the company proposes to work the Freeman mine which has been under lease to the International Pulp Co. A water power on the Oswegatchie river near Dodgeville has been secured, and it is planned to erect a mill of 75 tons daily capacity.

## ZINC AND LEAD

The deposits of zinc ore near Edwards, St Lawrence co., have not been worked during the past year. The inactivity has been due to causes which in no way reflect upon the value of the property, and there is a prospect that they will soon be removed and operations resumed once more. The developments thus far have been of the most promising character.

It seems probable that the occurrence is closely related to the pyrite deposits which are found in the schists at Hermon, Gouverneur and other localities in St Lawrence county and which at times carry a small quantity of zinc blende. The schists are metamorphosed Precambric sediments and are generally associated with crystalline limestone of the same character as the wall rock at the zinc mines. The analogy between the two types of deposits is further emphasized by the presence of pyrite in considerable quantity in the zinc ore.

The deposits of zinc blende occur as replacements of the limestone along or near the contact with a laminated gneiss. They are at times disseminated through the limestone resulting in a lean ore of mixed blende and gangue gradually shading off into the country rock, and again are concentrated in zones which are sharply bounded

and have the appearance of veins. The limestone contains serpentine nodules that have been derived by alteration from a nonhydrous silicate probably pyroxene. The mineralization is no doubt due to underground circulations. These have found passage along the contact between the gneiss and limestone and to a lesser extent along fissures within the limestone. It may be noted that the extensive talc deposits of this section occur on the same limestone belt and in the immediate vicinity of the zinc ore bodies. As has been demonstrated by Prof. C. H. Smyth jr, the talc owes its origin to the influence of subterranean waters acting upon masses of tremolite and pyroxene in the limestone. The evidence is insufficient to justify at present anything as to the precise manner in which the zinc blende has been deposited.

Some work was done during the year on a deposit of galena situated near Pierces Corners, St Lawrence co. The property was worked several years ago, but was abandoned after a little exploration. The former shaft which was bottomed at 80 feet has been pumped out and will be deepened at least 100 feet additional. The work is being done by the Independent Lead Co., of New York city.

The lead mine near Otisville, Orange co., formerly owned by the Washington Mining Co., has been taken over by the Phoenix Lead Co. of Paterson, N. J. It was developed to some extent last year, and it is proposed to instal machinery for continuing the work during the present season.

# INDEX

Appendix 2

# Paleontology 17, 18

*Museum bulletins* 114, 118

17 Rochester and Ontario Beach Quadrangles
18 Portage and Nunda Quadrangles

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BULLETIN 409 AUGUST 1907

# New York State Museum

JOHN M. CLARKE, Director

**Bulletin 114**

PALEONTOLOGY 17

## GEOLOGIC MAP

OF THE

## ROCHESTER AND ONTARIO BEACH QUADRANGLES

BY

C. A. HARTNAGEL

*New York State Education Department*

*Science Division, June* 2, 1906

*Hon. Andrew S. Draper LL.D.*

*Commissioner of Education*

SIR: I beg to communicate herewith, for publication as a bulletin of the State Museum, a *Geological Map of the Rochester and Ontario Beach Quadrangles* together with the explanatory matter pertaining thereto.

Respectfully yours

JOHN M. CLARKE

*Director*

*Approved for publication this* 3*d day of June* 1906

A. S. Draper

*Commissioner of Education*

New York State Education Department

# New York State Museum

John M. Clarke, Director

Bulletin 114

PALEONTOLOGY 17

# GEOLOGIC MAP

OF THE

# ROCHESTER AND ONTARIO BEACH QUADRANGLES

BY

C. A. HARTNAGEL

## INTRODUCTION

The area covered by this map is one long known in New York geology. As early as 1824, Prof. Amos Eaton[1] had given a brief account of the geology of this region. Later, in the days of the original survey of the fourth district, Prof. James Hall carefully exploited the geology of Monroe county, and through the long intervening years his report has served as a standard for the general geology of the region.

In carrying on the investigations for the present work, I have had the cordial cooperation of local geologists to whom I desire to express my appreciation and thanks. Prof. H. L. Fairchild has contributed information relative to the drift-covered area found in the southern part of the map and has given suggestions in regard to the units of sedimentation which have been used on the map. Prof. A. L. Arey has contributed a map on which were recorded rock excavations which are no longer accessible. This has been an aid in determining the contact lines within the city limits. Mr G. H. Chadwick directed my attention to numerous outcrops which were indicated on a topographic sheet submitted for my use.

1 Geological and Agricultural Survey of the District Adjoining the Erie Canal.

The region mapped lies between 43° and 43° 20′ north latitude and 77° 30′ and 77° 45′ west longitude, and exclusive of Lake Ontario comprises an area of 239 square miles. The variation of the magnetic from the true meridian in this section is 8° west of the true north.

The hight of the lowest area on the map is on the shore of Lake Ontario which is 247 feet above tide. The highest points are in the vicinity of the Mendon hills, approximately 850 feet above tide. The higher elevations are due to drift accumulations upon the soft Salina strata.

The city of Rochester is situated nearly in the center of the map and many fine rock sections are shown along the Genesee river well within the city limits, while the numerous steam and trolley roads running from the city make most of the other areas of the map readily accessible.

On the north, the area mapped is bounded by Lake Ontario. From the northwest corner of the map the lake shore extends in a southeast direction as far as Irondequoit bay, from which point a northeast direction is assumed, making within the limits of this map the most southerly projecting point of Lake Ontario in New York. At the place where the lake has its greatest southern extension, Irondequoit bay opens. This bay, representing undoubtedly an unfilled preglacial channel, and though less than 5 miles in length, is the southernmost bay of this lake.

The "ridge road" or the shore line of ancient Lake Iroquois passes across the map from both sides of the Genesee river in a nearly east and west line, having a slight northerly trend. The "ridge road," while a conspicuous topographic feature, is not confined to any particular rock formation and is not to be confused as to its origin with the ridges or escarpments due to the erosion of the northerly edges of the southerly dipping rocks of this region.

South from the "ridge road" the rocks of the Niagaran group are spread over a considerable area, so that the rock terrace so well developed in Niagara county, here finds expression in a much lower one in which the rocks of Clinton age are chiefly concerned. This terrace is best shown in the town of Greece along the line of the present Erie canal. Southward the outcropping edge of the Lockport dolomite rises in some localities above the general surface as a small ledge, but is less conspicuous than the preceding one. At the ridge or escarpment at Lewiston on the Niagara river, the Lockport dolo-

mite forms the upper member and its outcropping edge is almost directly above the Medina, as is shown in the nearly vertical section exposed along the Niagara river at Lewiston. In the vicinity of Rochester, however, the northern edge of the Lockport dolomite has weathered back from the Medina for a distance which averages more than a mile.

The outcrops of the geologic formations on this map extend in a nearly east and west direction. Owing to the depth of the gorge, the upstream deflection of the outcrops are well shown in the Genesee river. Most interesting, however, is the southern V-shaped deflection of the rock outcrops, into which the southern end of Irondequoit bay extends. On the basis of the rock geology alone, we have here ample evidence of a valley far more ancient than that of the present Genesee, which cuts through the same series of rocks but 5 miles farther west.

A noteworthy feature and one which in no small degree has given to the vicinity of Rochester its geological prominence, is the fact that at two places and at but short distances apart, the rocks of the Niagaran group have been cut through by the Genesee river and the southerly extending streams tributary to Irondequoit bay, thus exposing to view and making possible the fine sections specially well shown along the Genesee.

The formations which are represented on the map all have a southeast dip of about 80 feet per mile and belong to the Ontaric or Upper Siluric system. Of the members comprising this system only the basal portion of the Medina is not represented in the region bordering on Lake Ontario. The southern portion of the map includes the members of the Salina stage. The Cobleskill dolomite is found a short distance south of the limits of the map. The Rondout waterlime and the Manlius limestone, the highest members of the Siluric system, are absent from this section of the State, thus making the Cobleskill the only formation of the Siluric, as known in western New York, that will not be represented on the map.

The formations involved are as follows in descending order:

| ERA OR SYSTEM | PERIOD OR GROUP | AGE OR STAGE | UNITS OF SEDIMENTATION REPRESENTED IN COLOR ON THE MAP |
|---|---|---|---|
| Ontaric or Upper Siluric | Cayugan | Salina | Bertie waterlime<br>Camillus shale<br>Vernon shale<br>Pittsford shale |
| | Niagaran | Niagara | Lockport dolomites with interbedded Guelph faunas<br>Lockport dolomites<br>Rochester shale |
| | | Clinton | Irondequoit limestone<br>Williamson shale<br>Wolcott limestone<br>Furnaceville ore<br>Sodus shale |
| | Oswegan | Medina | Upper Medina (sandstones and shales)<br>Lower Medina (shales) |

## Sequence of events preceding the deposition of the rocks of the Rochester area

Although the Medina is the lowest formation that is exposed in western New York, well records have shown that we have the complete older series as known in the Mohawk valley, around the southeast border of the Adirondacks and in Canada.

The following table gives the order of succession of the rocks of the Rochester region below the Ontaric or Upper Siluric as determined from well records.

| ERA OR SYSTEM | PERIOD OR GROUP | AGE OR STAGE | THICKNESS IN FEET [1] |
|---|---|---|---|
| Champlainic or Lower Siluric | Cincinnatian | Lorraine beds<br>Utica shale | 598 |
| | Mohawkian | Trenton limestone<br>Black River limestone<br>Lowville limestone | 954 |
| | Canadian | Beekmantown dolomite (Little Falls dolomite) | 137 |
| Cambric or Taconic | Saratogan | Potsdam | (?) |
| Archean ........................................... | | | 3 + |
| | | | 1692 + |

1 Fairchild, H. L. Roch. Acad. Sci. Proc. 1891. 1:184. There is some evidence indicating the presence of the Potsdam. *See* 2:95, 102, 216, 217.

Toward the close of Lower Siluric time the land and seas were becoming unstable. The culmination was finally reached with the Taconic revolution[1] which began near the close of the Lorraine and the great disturbance which followed resulted in the Green mountain uplift. The results of this mountain building were of great importance and affected the region from the St Lawrence to Alabama.

In New York the whole eastern portion of the State became land. With the elevation of the land, folding and a planing down of the surface began. Thus in the sections where folding and erosion were the most extensive, this planing down had the effect of bringing the older formations to view. Much of these folded and eroded rocks were included in the old term "Hudson River group," formerly supposed to be entirely above the Trenton, but which Dr Ruedemann[2] has shown includes beds which range in age from middle Trenton to the close of the Lorraine.

The western effect of this uplift in New York seems not to have extended farther than the east end of Lake Ontario, since in this vicinity we have the Oswego sandstone which is the lowest member of the Upper Siluric, following directly and in perfect conformity to the Lorraine shales.[3] The transition from the Lorraine beds to the Oswego sandstone is one of importance, for it involves the question of a possible equivalency herein to the Richmond beds of Ohio and Indiana. These latter beds which are above the Lorraine contain recurring Trenton fossils. The Oswego sandstone is almost nonfossiliferous and thus paleontological evidence for correlation is wanting. In the light of our present knowledge it seems best to regard the Richmond beds as deposited just as the Taconic revolution was in progress and just after the Lorraine deposits were brought to a close in eastern New York. These changes of conditions were most marked in New York and under their influence the Lorraine fauna disappears; but farther west the conditions appear to have been favorable for the development of the Richmond fauna.[4]

1 *See* Ulrich & Schuchert. N. Y. State Paleontol. An. Rep't. 1901. p. 646.

2 N. Y. State Mus. Bul. 42. 1901. p. 567.

3 Geol. N. Y. 3d Dist. 1842. p. 61.

4 The question involving the equivalency of the Oswego sandstone and the Richmond beds, as well as the system in which they belong, is one which requires considerations of such detail that it can not be discussed within the scope of this paper. The Oswego sandstone is therefore retained as a member of the Upper Siluric, although there is evidence which may show that all of the Oswego and probably part of the Medina could with propriety be included with the Lower Siluric.

All the strata which are shown in the Rochester region were laid down in the Mississippian sea. This sea in eastern New York was limited by a barrier which separated the waters of the Atlantic from those of the interior basin. As early as Medina time there was a subsidence of the land at least along the western side of the barrier, and as the Mississippian sea gradually transgressed toward the east, the deposits from the Medina to the close of the Salina overlapped the next older formation. There was a slight uplift at the close of the Clinton and the effects are noticeable in the central portion of the State where the upper portion of the Niagaran does not overlap the Clinton. Finally the Salina period was brought to a close by the submergence of the barrier to the east and we have once again the waters of the Mississippian sea mingling with those of the Atlantic.

## FORMATIONS

### In ascending order

**Medina formation.** This formation takes its name from Medina, N. Y. at which place an excellent section of the upper part is shown along Oak Orchard creek. It will best serve our purpose to describe the Medina of the Rochester region under two divisions.

*Lower Medina shale.* This division consists of an extensive series of soft, red shales, with occasionally a small amount of interbedded silicious material. The total thickness of the red shales is about 900 feet. The greater portion of the outcropping edge of the formation is concealed beneath Lake Ontario so that only about 100 feet are shown within the limits of the map. Along the Oswego river these shales are seen at numerous points. They are here more silicious and follow the Oswego sandstone, the lowest member of the Upper Siluric. The Oswego does not outcrop anywhere in western New York, but from borings we know that it is present with a thickness of about 85 feet.

The beds of this division are well shown in the gorge of the Genesee river from below the lower falls nearly to Charlotte. The rock as here exposed is made up of red arenaceous shales in which occasionally are found thin beds of sandstone. From below the lower falls the bed of the Genesee is entirely excavated in these red shales. Upon exposure to the atmosphere, they break up into small angular fragments, which in course of time disintegrate and form a soft reddish soil, which often becomes covered with vegetation. At

points where the rock is not too badly decomposed, there are sometimes found white and green bleached bands usually occurring at right angles to the bedding planes. Along the shore of Lake Ontario some of the harder beds may be seen. One such exposure is shown at Windsor Beach and another at Forest Lawn.

Throughout the time of the deposition of these red shales, the conditions were very unfavorable to the existence of life in these waters, and there have been no fossils found in the beds.

*Upper Medina sandstone and shale.* The passage from the lower to the upper division of the Medina marks a change in the character of sedimentation, brought about, in part, by a greater expansion of the sea. This change was accompanied by a clearing of the waters and the introduction of marine life. In central New York the lower division extends as far east as the vicinity of Rome. The upper division represented by about 100 feet extends 40 miles farther east nearly to Cherry Valley. To the east of Oneida county, this upper division has usually been referred to the Oneida conglomerate. This conglomerate has generally been correlated with the lower division of the Medina and considered as the stratigraphic equivalent of the Oswego sandstone. Since, however, this conglomerate forms the overlapping eastward extension of the Medina, it can only represent the upper part. From the close proximity of the Oneida to the Clinton wherever the conglomerate is found, and from the presence of the fossil Fucoides harlani, which is restricted to the upper Medina, the Oneida conglomerate is here considered a local facies of the upper Medina. In passing west from Oneida county, the upper Medina becomes less conglomeratic, though in the Rochester section pebbles are found in some of the upper layers. West from Rochester and in the Niagara region, the lower division is followed by about 25 feet of gray quartzose sandstone. This layer contains the remains of Lingula cuneata which is also found in the upper Medina at Rochester. This sandstone appears to correspond approximately to the base of the Medina of the eastern sections, both occurring at a little more than 100 feet below the base of the Clinton. In the Niagara region this sandstone is followed by a series of shales and thin-bedded sandstones. The shales are similar to those of the lower Medina and indicate a temporary return to conditions of sedimentation similar to those which prevailed during lower Medina time. The uppermost stratum of the Medina is

marked throughout western New York by a band of gray sandstone which at Rochester is 5 feet thick. This upper stratum has long been referred to as the "gray band" of the Medina.

In the Rochester region the changes so well marked to the east and the west are not well shown and the red color of the rock is retained up to the "gray band." In the Genesee gorge the upper division of the Medina comprises a series of sandstones with some interbedded shaly material. The harder projecting beds of sandstones are shown in the cliffs at the lower falls.

The thickness which may with certainty be ascribed to the upper division is about 60 feet, but on the basis of the adjoining sections the whole distance represented by the hight of the falls, which is 96 feet, should be included in the upper division.

The sandstones at the top of the Medina often show ripple marks and a cross lamination which makes the rock appear to be inclined. These are both indicative of shallow-water conditions at the time of deposition.

Fossils are not numerous in the upper Medina at Rochester. Fucoides harlani Hall (=Arthrophycus alleghaniensis Harlan) is the most interesting and occurs in the layers below the "gray band." It is an abundant fossil and has a wide distribution in the upper Medina, to which it appears to be confined and thus serves as an excellent horizon marker. It is known from the Medina of Pennsylvania and Virginia. Though usually regarded as a marine plant it has recently been shown by C. J. Sarle[1] to be of burrow origin and probably Annelidan.

The closing phase of Medina time is represented by the "gray band," which is excellently shown at the lower falls, where this gray layer shows in marked contrast between the Clinton shales above and the red Medina below.

The sandstones of the upper Medina are of great economic importance. The excellent quality of this stone for structural and street work has given it a wide reputation. All the sandstone quarries between the Genesee and the Niagara rivers are in the upper division of the Medina.

**Clinton formation.** This series of rocks follows directly above the Medina. The name is from the village of Clinton in central New York where these beds attain a thickness of about 175 feet.

1 Roch. Acad. Sci. Proc. 1906. 4: 203.

The Clinton in this section is made up of a rather complex series of limestones, shales, sandstones, and beds of iron ore. On account of the variable nature of this formation, it was termed by Vanuxem the "Protean group." The maximum thickness is in the vicinity of Clinton and from this point the formation thins both to the east and the west. In Wayne and Monroe counties, five distinct divisions can be recognized. The section of the Clinton rocks as exposed in the Genesee gorge is complete, every foot of the formation being accessible. On account of the fine sections shown at Rochester and farther east in Wayne county, it has been deemed advisable to describe the different units of sedimentation under distinct names. This it is hoped will in the future be an aid in the attempt to work out the relation between the Clinton of central and western New York.

The names of the subdivisions of the Clinton beginning with the lowest are as follows: (1) Sodus shale; (2) Furnaceville iron ore; (3) Wolcott limestone; (4) Williamson shale; (5) Irondequoit limestone.

*Sodus shale.* This is a bright green shale and at Rochester it is 24 feet thick. The name is from the town of Sodus in Wayne county where this division is well shown in the vicinity of Sodus bay. This shale succeeds the Medina abruptly. It appears to be much thinner at some points in Wayne county than at Rochester, but thins in going west, and at Niagara it is but 6 feet thick. The shale is quite soft, splits into very thin layers and is easily broken up, and when exposed to the atmosphere changes into a greenish, claylike material. The shale of the lower division is very unctuous and may be distinguished from the upper shale by its more uniform color, the absence of limestone bands and by the almost complete absence of fossils. The few fossils that do occur are mostly so called fucoids which remain attached to the lower side of the firmer bands of rock when the latter are removed. A number of imperfectly preserved brachiopods are also found.

The best exposure of this rock is in the gorge between the lower and middle falls of the Genesee. It is well shown for a considerable distance along the gorge where it is seen to rest upon the "gray band" of the Medina. Another readily accessible exposure is along Densmore creek[1] at which place fucoids may be obtained.

1 It is probable that sewer excavations now in progress along Densmore creek, will destroy the section which at present is favorable for the study of the lower Clinton.

*Furnaceville iron ore.* The name of this bed is from Furnaceville in Wayne county, near which place the ore has been worked for many years. The ores of the Clinton[1] have a very wide areal distribution and have various names applied to them, as oolitic, lenticular and fossil ores. In structure the ore varies in different sections. At Rochester there is a replacement of fossils, such as crinoids and bryozoans. In addition there is a considerable number of spherules, each made up of a nucleus of silica surrounded by a number of thin concentric coats of ferric oxid and silica. The ore at Rochester is strictly a fossil ore, but owing to the presence of lenticular shaped spherules, it may be referred to as lenticular or oolitic ore. The ore is hematite or the sesquioxid of iron ($Fe_2 O_3$). On account of the earthy texture of this ore, it is always red in color.

In the vicinity of Clinton, N. Y. there are three distinct beds of these ores. In passing west, the upper beds fail and the remaining one shown in the Rochester section is 14 inches thick. This ore bed can not extend far west of Rochester, for here is the last known exposure and at Niagara Falls the bed does not exist.

The ores of the Clinton group are of great economic importance and beds as thin as 22 inches are at present being profitably worked. In New York the iron is mined at Ontario, Wayne county, Sterling Station, Cayuga county, and near Utica in the town of Kirkland.

*Wolcott limestone.* This limestone has been traced from the Niagara river eastward to Cayuga county. It undoubtedly extends farther east, but on account of poor exposures and probable change in lithologic features and faunal contents, it has not been recognized. This limestone is named from Wolcott in Wayne county, from which point west to beyond the Genesee the large brachiopod Pentamerus oblongus is very characteristic of the division and on this account it was formerly called the Pentamerus limestone. This fossil becomes less abundant in going west from Rochester and at Niagara it is not found though farther west in Ohio and Indiana it occurs in the Clinton strata and again higher up in the Guelph limestone.

At Rochester this limestone is 14 feet thick. It is well shown at the middle falls, of which it forms the crest. Loose fragments of the

1 *See* Smythe, G. H. jr. Am. Jour. Sci. 1892. 43: 487.

limestone are often found made up largely of the fossil Pentamerus and fragments of crinoids.

The Wolcott limestone has the appearance of a crystalline limestone, and on account of its power to resist heat it has been used as a firestone for chimneys, hearths etc.

Associated with it are a number of minerals, some of which are found in cavities in the rock and sometimes in geodes. Of these, gypsum, barite, chalcopyrite, malachite and several varieties of quartz, including chalcedony and carnelian, are the more numerous.

*Williamson shale.* This division is well developed in Wayne and Monroe counties. West from Monroe the formation is less developed and on the Niagara river it is not found, the Irondequoit limestone resting directly upon the Wolcott limestone. As the Furnaceville ore is also absent we have but three of the five divisions of the Clinton represented at Niagara.

The Williamson shale is 24 feet thick at Rochester and like the other divisions of the Clinton, it is best shown in the gorge of the Genesee. The shale is shown in both banks of this river, above the middle falls and extending north from the lower falls in the sides of the gorge.

As it occupies a position between two limestones it appears in a marked contrast where the total thickness is shown.

When the position of this shale is not indicated by the presence of the limestones either above or below, it is likely to be confused with the Sodus shale, specially when the outcrops have been badly weathered. The Williamson shale may, however, in most cases, be distinguished from the Sodus shale as below indicated. The Williamson shale is not of so uniform green color and interbedded in it is a number of purple bands. The mass as a whole is very fossiliferous and in it are found two or three thin bands of pearly limestone. These limestone bands are made up of closely crowded shells of Anoplotheca hemispherica, to which they owe their pearly luster. These limestones often project from the shale and form small ledges. Interbedded in this formation there are also found some very dark thin shales containing graptolites in great profusion. It is of interest to note here that in New York this bed of graptolites marks the highest horizon at which they are known to exist in

abundance. Other species occur in the Rochester shale and a few species extend into the Devonic. The group however reaches its culmination in the lower formations of the State and when found they are nearly always seen to occur in thin black bands of shale similar to that of the Clinton.

The graptolite shales are well shown in Palmer's glen near Brighton. Here the shales appear well down in the glen where the two streams unite. Loose fragments of dark shale covered with graptolites may be found in the stream bed, while the bank of the stream affords a very favorable place for collecting.

*Irondequoit limestone.* This limestone constitutes the highest member of the Clinton group in this section. The name is from the town of Irondequoit, which lies between Irondequoit bay and the Genesee river.

The limestone rests directly on the Williamson shale, and its numerous layers of limestone are separated by bands of shale of various thickness. In the lower portion of the formation, the shale is similar to the green shale of the Williamson member, but in the upper part the shale is gray and resembles that of the Rochester formation. Some of the layers of limestone show a crystalline structure, the rock being made up largely of the broken remains of corals, crinoids and various shells. The limestone is quite variable in composition, and from the presence of iron pyrites it is often stained with iron as a result of the decomposition of the pyrites.

Of special interest is the occurrence of numerous reeflike structures at the top of this limestone. These are mostly lenticular in shape and several are found in the outcrops on the Genesee river. These structures are very numerous and can be observed at many points where the Irondequoit limestones outcrop, from Wayne county to the Niagara river.

A special study of these reef structures has been made by C. J. Sarle,[1] who has shown that they consist mainly of masses of bryozoans which are still in position as when formed. The rapid growth of these masses is indicated by the fact that in some cases they more than kept pace with the accumulating sediment and the mass rises above the general level. The growth of these masses finally ceased

1 Amer. Geol. Nov. 1901. p. 282. *See also* Clarke. N. Y. State Paleontol. An. Rep't. 1901. p. 428–31.

with the increasing amount of silt beginning with the deposition of the Rochester shale. The arching of the Rochester shale over some of these masses forms a conspicuous feature of these structures.

In the Genesee gorge these reefs may be observed at the base of the Rochester shale, not far above the water level, just above the Rome, Watertown & Ogdensburg Railroad bridge. These are the most accessible for examination, though others are found along the gorge and in Palmer's glen. These structures were very favorable for the existence of other forms of life. Specially is this true of those which in their larval and later form had a fixed mode of life. For such, these reeflike structures offered an excellent place for attachment.

The number of species already recorded from these reefs is more than 100. Some species occur in large numbers, as for example the brachiopod Whitfieldella nitida and the trilobite Illaenus ioxus. This trilobite is usually not found complete, but multitudes of cephalic and caudal shields are found closely packed together. Other common forms include Atrypa reticularis, Camarotoechia neglecta, Spirifer crispus, Leptaena rhomboidalis and Calymmene niagarensis. The affinities of the fauna of the Irondequoit limestone and specially of the lenses, show a close connection with the fauna of the Rochester shale.

**Niagara formation.** *Rochester shale.* The term Rochester shale was first used by Hall in 1838. Since that time the term Niagara shale has been frequently applied to this formation, but in the revised nomenclature of the New York rock series by Clarke and Schuchert, the term Rochester shale was revived with its original significance.

Along the Genesee river this formation forms the top of the gorge, from north of Driving Park bridge, nearly to the upper falls where a few feet of the lower part of the Lockport dolomite are shown. With the exception of these few feet of dolomite at the crest, the whole vertical hight of the falls is made up of Rochester shale. The river bed from below the falls to just below the Vincent street bridge, where the Irondequoit limestone shows, is excavated in this shale.

The shale is shown at numerous localities about Rochester and in excavating in the north part of the city the shale is often encountered. It may also be observed near the canal in the town of Greece and in several of the ravines leading to Irondequoit bay.

The Rochester shale is known as far eastward as Oneida county, and probably extends still farther east into Herkimer county where a shale similar to it is found just below the concretionary layers of the Lockport dolomite. It is well developed at Wolcott in Wayne county where it is seen at the falls in the village. From here to the Niagara river, it outcrops at many points. At Niagara it forms the lower 80 feet of the falls escarpment. The Rochester formation has a wide distribution in the interior of the United States where, though the lithologic features have changed, it may be recognized by the fossils.

In the Rochester region this shale is about 85 feet thick. It is of quite a uniform dark blue color at the base and nearer the top it becomes lighter in color, where the bands of limestone appear. The shale as a whole is very evenly bedded and the layers vary but little in hardness and as a result the faces of some of the shale cliffs are very even. On exposure it changes to a lighter color. The upper layers are hard and quite resistant and have been quarried for foundation purposes. The lower part when freshly excavated appears quite firm, but on exposure it checks rapidly and soon disintegrates into clay.

The Rochester shale is very rich in fossil remains. At the base, fossils are not numerous, but a few feet above they become abundant. Toward the top they again become less abundant, the upper few feet being practically barren. Fossils may be obtained along the gorge where is found much talus material. This is often badly broken up, but fragments of the harder calcareous layers are found with fossils in abundance. Excavations in the soft shales often bring to view fine specimens, but if not immediately collected, they will be destroyed through the disintegration of the mass which quickly follows. The excavations for the new barge canal in the town of Greece are at present in the Rochester shale and undoubtedly large collections could be made at this point. The number of species recorded is very large and the following list includes the more common forms found in the Rochester region:

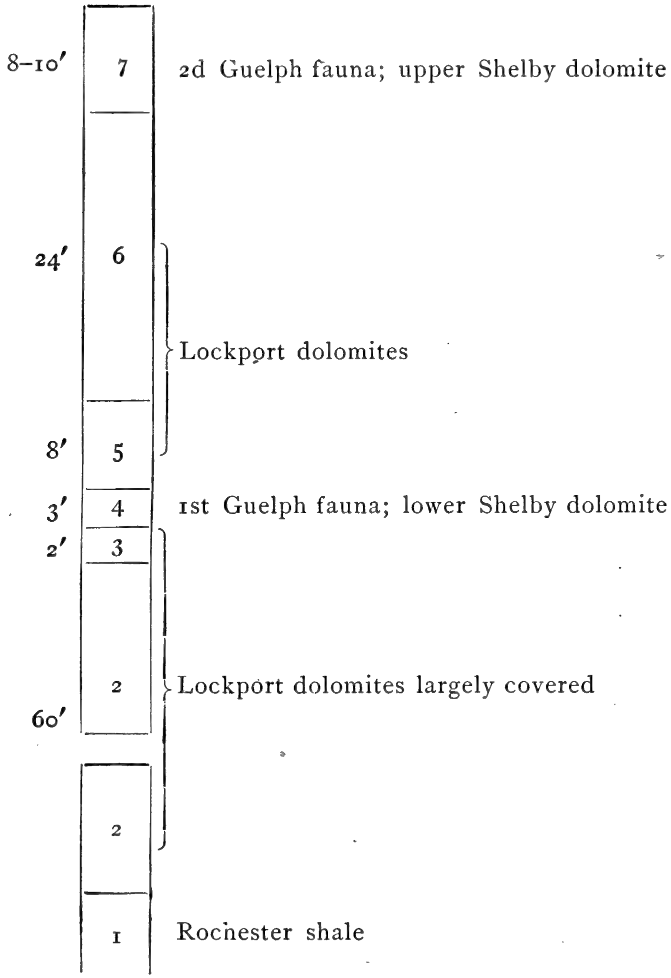
Enterolasma caliculus *Hall*
Favosites constrictus *Hall*
Cladopora seriata *Hall*
Chilotrypa ostiolata *Hall*
Subretepora dichotoma *Hall*
Fenestella elegans *Hall*
Semicoscinium tenuiceps *Hall*
Polypora incepta *Hall*
Sagenella membranacea *Hall*
Dictyonema retiforme *Hall*
Inocaulis plumulosus *Hall*
Eucalyptocrinus decorus *Phillips*
Caryocrinus ornatus *Say*
Lingula lamellata *Hall*
Pholidops squamiformis *Hall*
Dalmanella elegantula *Dalman*
Rhipidomella hybrida *Sowerby*
Orthis flabellites *Hall*
Orthostrophia fasciata *Hall*
Plectambonites transversalis *Wahlenberg*
Leptaena rhomboidalis *Wahlenberg*
Orthothetes subplanus *Conrad*
Spirifer sulcatus *Hisinger*
S. crispus *Hisinger*
S. niagarensis *Conrad*
S. radiatus *Sowerby*
Whitfieldella nitida *Hall*
Atrypa reticularis *Linné*
Camarotoechia neglecta *Hall*
Dictyonella corallifera *Hall*
Pterinea emacerata *Conrad*
P. undata *Hall*
Lyriopecten (?) orbiculatus *Hall*
Diaphorostoma niagarense *Hall*
Gomphoceras sp.
Orthoceras imbricatum *Sowerby*
O. virgatum *Sowerby*
O. annulatum *Sowerby*
Cyrtoceras subcancellatum *Hall*
Conularia niagarensis *Hall*
Calymmene niagarensis *Hall*
Illaenus ioxus *Hall*
Dalmanites limulurus *Green*
Ceraurus niagarensis *Hall*
Homalonotus delphinocephalus *Green*
Lichas boltoni *Bigsby*

*Lockport dolomite.* Following the deposition of the Rochester shale and continuing until Salina time, there was laid down a series of magnesian limestones or more properly dolomites. These beds as early as 1838 were described by Hall under the term Lockport limestone.

In western New York this series of dolomites is characterized by the presence of two distinct faunas, which though subject to variation in species combinations may still be referred to as alternating or recurring.

While similar conditions exist at Rochester, the section which most clearly illustrates these relations is at Shelby in Orleans county. At this locality, Clarke and Ruedemann[1] have constructed the following section:

1 N. Y. State Mus. Mem. 5. 1903. p. 12.




Immediately above the Rochester shale, there are 62 feet of Lockport dolomite with its characteristic fauna. Then in the next 3 feet is the first appearance of the Guelph fauna. This is succeeded by 32 feet of Lockport dolomite with its characteristic fauna and finally above this, in the 8 to 10 feet of dolomite, is the second appearance of the Guelph fauna. The dolomite containing the upper Guelph fauna completes the section at Shelby, the interval to the Pittsford shale not being shown.

In Monroe county the Salina appears to follow just above the last appearance of the Guelph fauna as there known. It should be

stated, however, that the closing stages of the dolomite period in western New York were extremely complex, and we are not in a position to say positively that everywhere in New York State the upper Guelph fauna terminates this series.

In the excavations made at Dufferin islands at Niagara Falls, the section which was temporarily exposed showed a fauna that included both Lockport and Guelph species. As this horizon is above the crest of the falls, it represents a higher horizon than the upper Guelph, as determined along the Niagara gorge and at Shelby. Above this exposure at the falls there are at least 40 feet before the Salina series appears. In the type section for the Guelph in Canada, it is considered as following the Lockport and is there regarded both as a faunistic and lithologic element in the succession of Siluric rocks.

Of the two Guelph beds at Shelby, it is of importance to note that the fauna of the lower is of the purer Guelph type, while in the upper the presence of Lockport species is much more pronounced.

The 32 feet of dolomites separating these two faunas are quite free from Guelph fossils, the species found being all of the Lockport type. At Rochester it is the upper Guelph fauna that appears in greatest force and its admixture and complication with the Lockport fauna is very noticeable.

In regard to the Lockport and Guelph faunas, it should be stated that the former represents the normal or indigene fauna, which is the immediate successor of, and derivative from the Rochester shale fauna. The Guelph fauna on the other hand is not to be considered as derived from the Lockport and Rochester shale faunas as presented in the strata which immediately precede the first appearance of the Guelph fauna. It is, therefore, in the New York province to be regarded as an alien fauna which invaded this section of the State from the west and temporarily displaced the normal or Lockport fauna. The peculiar conditions which brought about the introduction of the Guelph fauna into the Lockport sediments will be stated later.

On the map the lower portion of the Lockport dolomites which is free from the Guelph species we have designated simply as Lock port dolomites and the upper portion as Lockport dolomite with interbedded Guelph faunas.

The lower part of the Lockport is well shown at the crest of the upper falls at Rochester, at the quarries on Goodman street and at the culvert where the main line of the New York Central Railroad crosses Allen creek.

The change from the Rochester shale is a very gradual one. This transition is accompanied by change in color of the rock as may be observed from the Platt street bridge. It will be observed that the more massive layers which form the crest of the falls extend for a distance at the top of the gorge on both sides of the river. The admixture of the clayey material in these basal layers of the Lockport give it the chemical composition of a natural hydraulic cement. These layers, however, have been used but little for cement purposes.

Some of the upper layers which form the crest of the falls contain a number of crinoid stems, some of which measure 18 inches in length. Farther west in Monroe county these crinoids become more numerous and at Lockport they occur in such abundance that the layer containing them has been designated the "crinoidal limestone."

The quarries on Goodman street show the transition beds to the best advantage. Portions of the quarries extend down into the Rochester shale. At the bottom of these quarries native sulfur is found on some of the dark layers of the Rochester formation. A fine sulfur spring was encountered in excavating in this formation for the barge canal in the town of Greece. Some of the basal layers of the Lockport are separated by thin layers of shale and are very irregular in their stratification. Cross-bedding is very characteristic of many of the lower portions which present an appearance of sandstone. It may be shown, however, that most of the grains consist of small particles of dolomite.

The two sections which show the Lockport dolomites to the best advantage are along the Genesee river from the upper falls to the rapids near South park and along Allen creek, 3 miles southeast from Rochester. The former section is about in the center of the city of Rochester and except where obstructed by dams, nearly the entire section can be examined at times of low water.

At Rochester the divisions of the Lockport dolomites, based mainly on the lithologic character of the rock, were described by Hall[1] as follows in descending order:

1 Geol. N. Y. 4th Dist. 1843. p. 87.

5 Thin-bedded dark gray or brownish limestones. Few cavities. Highly bituminous. Sometimes contains nodules of hornstone.
4 Thick-bedded dark or bluish gray limestone with irregular cavities, and often silicious accretions, or hornstone. Surface very ragged from weathering. Highly bituminous.
3 A lighter colored subcrystalline mass, very irregularly stratified, contorted and concretionary.
2 A bluish gray subcrystalline mass, mostly thin-bedded, and separated by seams of dark shale.
1 Gray or bluish gray silicious limestone; hydraulic limestone, or beds of passage from the shale below.

The Allen creek section, while not a continuous one, is favorable for examining the varying characters of this series. The lowest exposure is seen just north from the culvert on the main line of the New York Central Railroad. The outcrops along the creek and at the Corbett quarry well expose the lower layers of the dolomite. The irregular bedding of some of the lower layers is well shown at the quarry. This exposure continues through the culvert to the south side of the railroad and then follows a covered interval of about 10 feet. The next exposure is seen at Allen creek both above and below the East avenue road. The rock is a very hard dolomite containing a number of cavities. Corals, fragments of crinoids and Stropheodonta profunda have been obtained here. After another covered interval of about 20 feet, an exposure is seen just below where the stream is crossed by the highway. The lower part of the outcrop consists of evenly bedded dolomites, overlain by darker rock containing much Stromatopora. About 2 feet of concretionary layers are shown above the dark dolomite. Farther up the stream are 10 feet of dark dolomites with corals, followed by 5 feet of hard thin-bedded layers and terminated above by 12 feet of dark brown dolomite containing Stromatopora, Halysites and Favosites. This is the highest exposure of the Lockport dolomite on this creek. The next exposure above, which is just south of the road leading to South Park, belongs to the Salina series.

The following is a condensed section along Allen creek, the thickness of which, as in the above description, is taken from Clarke and Ruedemann.[1] In ascending order:

| | | FEET |
|---|---|---|
| 1 | Basal beds of irregular bedded rough dolomites ........... | 20 |
| 2 | Covered interval ........................................ | 10 |

1 N. Y. State Mus. Mem. 5. 1903. p. 18.

| | | FEET |
|---|---|---|
| 3 | Hard, dark dolomites with cavities. *Stropheodonta profunda*, crinoid fragments and corals are found. The upper part of this exposure has the stratigraphic position of the lower Shelby dolomite which contains Guelph fossils.. | 25 |
| 4 | Covered interval .................................... | 20 |
| 5 | Even bedded dolomites.................................. | 5 |
| 6 | Dark dolomites with Stromatopora........................ | 10 |
| 7 | Fine, hard, thin-bedded dolomite........................ | 5 |
| 8 | Dark brown dolomite with corals........................ | 12 |
| 9 | Covered interval. Probably represents upper Guelph horizon........................................ | 15 |
| | Total thickness of Lockport series....... ............... | 122 |

The above section does not include a few feet at the base and at the top of the section. However, the total thickness of the Lockport dolomites is not far from 130 feet.

The fauna of the Lockport dolomite exclusive of the Guelph species is not an abundant one in the Rochester section, the more prolific development being to the west in Orleans and Niagara counties. Of about 40 species described by Hall, less than 10 are mentioned as occurring in Monroe county.

The total number of Guelph species at present known in New York is 71. Species to the number of 52 are recorded from Rochester and of these 17 species are common to the Niagaran fauna of New York. Most of the species from Rochester are found in white chert nodules which occur in the upper part of the dolomites. The Nellis quarry was formerly the source of a number of these nodules, but as the quarry is now filled they can no longer be obtained.

In excavating for the new West High School building, which is but a few rods from the Nellis quarry, a considerable amount of material was taken out which yielded a number of the nodules with finely preserved fossils. From these excavations there were also obtained a number of fine crystallized specimens of dolomite, calcite, fluorite, gypsum and galena. Aside from the fossils in these nodules, Guelph species are quite rare in the dolomites. Occasionally, however, specimens are found lower than the chert-bearing dolomites as known in the vicinity of the high school building.

In the Tanner quarry Poleumita scamnata has been found and several specimens of this species were obtained from the Trabold quarry, a few miles west of Rochester. It appears quite probable that we have other earlier manifestations of the Guelph fauna in the vicinity of Rochester and that patient search may reveal the presence of additional species that would bear some relation to the lower Shelby fauna.

Scattered over the surface of the country about Rochester, are a number of Lockport boulders which weather brown, and contain cavities which give the rock a very scraggy appearance. Occasionally on some of these boulders fossils are found standing out in relief. On breaking the rock, the glistening surface and petroleum odor are very noticeable.

The physical conditions during late Lockport time are of special interest for they involve the last of the true marine deposits of Siluric time, and throw much light on the presence of the Guelph fauna in the dolomites, as well as accounting for the high magnesian content of the rock. We must conceive of a shallowing Lockport sea, gradually becoming more inclosed. This was accompanied by an increase in the saline and magnesian content of the sea water. Under these conditions coral reefs became very abundant and favorable for the existence of life under new conditions and environments. Clarke and Ruedemann[1] state that the chert-bearing dolomite is highly magnesian, containing about 44% of magnesian carbonate.

It shows no stratification, is usually dark and so bituminous that it gives off a strong petroleum odor when fresh or when struck with the hammer. It is for the most part granular, though compact and contains numerous white silicious concretions in which the fossils are preserved. We may note that the admixture of bituminous matter in these Guelph dolomites is a further indication of their coral reef origin, or is at least in harmony with recent observations on living coral reefs where petroleum has been found in process of formation as a result of the transformation of the organic matter of the reef. The cavernous character of the dolomite may, according to the views of Walther and others, be regarded not as the result of subsequent corrosion, but as the remnants of original cavities in the growing reef which have not been closed up with coral sand.

The chert concretions which are characteristic of the upper Guelph horizon at Rochester and Shelby are doubtless a by-product of the diagenesis which altered the coral lime rock to a dolomite.

1 N. Y. State Mus. Mem. 5. 1903. p. 115, 116.

These nodules contain fossils with their exterior ornament finely retained, that is, replaced in amorphous silica, while in the dolomite the shell substance has been removed and never replaced. The source of the silica here, as in the like segregations associated with limestone, is probably to be found in the spicules of sponges.

It will thus be seen that with the increasing salinity, the Lockport fauna gave way to the Guelph fauna. At first this condition was only temporary and the Lockport fauna under normal conditions once more establishes itself, but is finally displaced by the Guelph fauna which in turn disappears with the formation of the Salina sea.

The Guelph fauna as a whole presents two distinct types of structure, in that the shells are either large and heavy-shelled or small and thin-shelled. The first of these may be regarded as living on the exposed edges of the coral reefs and the second in the sheltered places among the coral reefs. It may also be stated that the Lockport and Rochester forms found in the Guelph mostly belong to the smaller type.

The following is a list of Guelph[1] species which have been found in the vicinity of Rochester. Those marked with an asterisk are also found lower in the Niagaran of New York.

**Corals**

Zaphrentis *cf.* racinensis *Whitfield*
*Enterolasma *cf.* caliculus *Hall*
*Diplophyllum caespitosum *Hall*
Heliophyllum *sp.*
*Favosites niagarensis *Hall*
F. hisingeri *Edwards & Haime*
*F. gothlandicus *Lambe*
F. forbesi *Edwards & Haime*
*Halysites catenularius *Linné*
*H. agglomeratus *Hall*
Stromatopora galtensis *Dawson*
Clathrodictyum ostiolatum *Nicholson*

**Brachiopods**

Crania *sp.*
*Dalmanella *cf.* elegantula *Dalman*
*Rhipidomella *cf.* hybrida *Sowerby*
*Camarotoechia? neglecta *Hall*
C.? indianensis *Hall*
*Spirifer crispus *Hisinger*
*Whitfieldella nitida *Hall*

**Pelecypods**

Mytilarca eduliformis *Clarke & Ruedemann*
Pterinea subplana *Hall*
Conocardium *sp.*

**Gastropods**

Trematonotus alpheus *Hall*
Diaphorostoma niagarense *Hall*
Poleumita scamnata *Clarke & Ruedemann*

1 All the species of the Guelph of New York have been described and illustrated by Clarke and Ruedemann in Memoir 5 of the New York State Museum.

P. sulcata *Hall*
P. crenulata *Whiteaves*
Eotomaria durhamensis *Whiteaves*
E. areyi *Clarke & Ruedemann*
E. kayseri *Clarke & Ruedemann*
Lophospira bispiralis *Hall*
Hormotoma whiteavesi *Clarke & Ruedemann*
Coelidium macrospira *Hall*
C. *cf.* vitellia *Billings*
Macrochilina *sp.*
Euomphalus fairchildi *Clarke & Ruedemann*

**Cephalopods**

Orthoceras trusitum *Clarke & Ruedemann*
*Dawsonoceras annulatum *var.* americanum *Foord* (var.)
*Kionoceras darwini *Billings*
K. *cf.* medullare *Hall*
Cyrtoceras arcticameratum *Hall*
C. orodes *Billings*
Cyrtoceras *cf.* brevicorne *Hall*
C. bovinum *Clarke & Ruedemann*
Trochoceras desplainense *McChesney*
Poterioceras sauridens *Clarke & Ruedemann*
Phragmoceras parvum *Hall & Whitfield*

**Vermes**

*Cornulites arcuatus *Conrad*

**Crustacea**

Leperditia balthica *var.* guelphica *Jones*
L. *sp.*
*Calymmene niagarensis *Hall*
Proetus *sp.*

**Salina formation.** This term was introduced by Dana and is used in place of the older name "Onondaga salt group." In central and western New York, the Salina outcrops in a broad belt 5 to 20 miles wide. The formation thins out entirely in Albany county, where the upper part overlaps the Champlainic or Lower Siluric strata. To the west it has been traced as far as Georgian bay in Canada. The maximum thickness of the formation is 1200 feet in Wayne and Cayuga counties and thins both to the east and to the west of this section.

In the vicinity of Rochester, the entire thickness is about 600 feet and at Buffalo, 450 feet. From the soft nature of the rocks of this formation, no conspicuous ledges are anywhere to be seen and in a large degree the formation has been so covered by glacial drift that outcrops are rare. In western New York, the rocks all have a southerly dip, and as the soft Salina shales occupy a position between the hard rocks of the Lockport and Onondaga formations, the drainage is often seriously affected, specially where there is but a small amount of glacial drift. Eastward from the Rochester region, the Salina strata are covered by a large number of drumlins and the swamps

which occur are of limited area and as a rule are found in the depressions between the drumlins. Westward from Rochester, on the other hand, the drumlin area has a much more limited extent and large portions of the Salina shales, and the Lockport dolomites, where those shales have been removed, are covered by the Tonawanda and Oak Orchard swamps. The surplus water of this swampy area is carried away by Tonawanda creek, which empties into the Niagara river; Oak Orchard and Sandy creeks which empty into Lake Ontario; and Black creek which empties into the Genesee at Genesee Junction. It may here be stated that the drainage of the Salina area west of the Oswego river is mainly in an east or a west direction and that of all the streams flowing into Lake Ontario, between the Oswego and Niagara rivers, the Genesee and the Irondequoit are the only ones that cut through all the Siluric rocks of this region and thus provide drainage for all of the Salina area found within the limits of the map. The limited swamp areas which exist are, one in the vicinity of Brookdale in the town of Chili, and the other in the depressions of the Mendon hills. Another small swamp or peat marsh found in one of the depressions of the Pinnacle hills, has been described by Fairchild and Barnum.[1]

The Salina beds include four distinct stratigraphic units recognizable here and in sections of central New York. In ascending order these are: (1) Pittsford shale; (2) Vernon shale; (3) Camillus shale; (4) Bertie waterlime.

*Pittsford shale.* This shale is the lowest member of the Salina series. The name is from the town of Pittsford a few miles southeast from Rochester. This formation and the Bertie waterlime which marks the upper limit of the Salina are both characterized by a eurypterid fauna and thus the limit of the Salina is determined by the paleontologic as well as by the stratigraphic relations. This shale is a newly recognized element in the Salina series. I. P. Bishop[2] mentions a locality on Grand island in the Niagara river where a black shale is exposed at or near the bottom of the Salina. No fossils are mentioned from the Grand island locality. The credit for finding this shale and its contained fauna at Pittsford is due to C. J. Sarle.[3] The only other locality where a shale is known which may

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1 Roch. Acad. Sci. Proc. 1900. 3:201-4.

2 N. Y. State Geol. 15th An. Rep't. 1895. p. 311.

3 N. Y. State Paleontol. An. Rep't. 1902. p. 1080.

be referred to the Pittsford, is in one of the south branches of Moyer creek, a few miles southwest from Frankfort, Herkimer county.[1] At this locality there are 15 feet of dark olive shale exposed directly above the concretionary layers of the Lockport dolomite. The only fossil from this locality is a small Lingula which occurs quite abundantly. It is possible that further search will reveal at this locality other species. Above the shale exposed along the south branch of Moyer creek the Vernon shales are excellently exposed, and in some places the dark shales are coated with the red material from above.

At Pittsford these dark shales have been obtained only from excavations made along the Erie canal. Their thickness here is about 20 feet. They consist of thin layers of black and green mottled shale with some thin layers of hard dolomite. The eurypterids are found almost exclusively in the dark shale; the most common forms in the dolomite are a Pterinea and a species of Leperditia.

The most interesting species among the crustaceans is the eyeless form Pseudoniscus roosevelti,[2] described by Clarke and the new genus Hughmilleria[3] described by Sarle. The genus Hughmilleria is a connecting link between Pterygotus and Eurypterus and according to Sarle is more closely related to the former.

The fauna of the Pittsford shale bears but little relation to either the Lockport or Guelph fauna which preceded it. It is not to be considered as derivative from the above faunas, but represents an element quite distinct. As before noted the Guelph fauna was the outcome of peculiar physical conditions, so the Pittsford fauna represents a still more contracted and shallow sea with increase of salinity. This increase in salinity which marks the introduction of the Salina, finally had the effect of displacing the Pittsford fauna. From this time onward, throughout the greater part of Salina time, this sea was practically lifeless,[4] and it is interesting to note that a eurypterid fauna which was the last to survive in the Pittsford shale,

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1 Since the above was written a eurypterid fauna having close affinities with the Pittsford, has been found in the thin intercalated black shales of the Shawangunk conglomerate of eastern New York.

2 N. Y. State Paleontol. An. Rep't. 1900. p. 89.

3 N. Y. State Paleontol. An. Rep't. 1902. p. 1091.

4 A species of Leperditia (L. cf. scalaris), and a form of Meristella are known from the Camillus shale.

was also the first to appear in the Bertie waterlime which marks the close of the Salina.[1]

The following species have been obtained from the Pittsford shale:

| | |
|---|---|
| Favosites *sp.* | Pseudoniscus roosevelti *Clarke* |
| Orthothetes *cf.* interstriatus *Hall* | Hughmilleria socialis *Sarle* |
| Pterinea *cf.* emacerata *Conrad* | H. socialis *var.* robusta *Sarle* |
| Cephalopod *sp.* | Eurypterus pittsfordensis *Sarle* |
| Ceratiocaris praecedens *Clarke* | Pterygotus monroensis *Sarle* |
| Emmelezoe decora *Clarke* | |

*Vernon and Camillus shales.* On account of the thick covering of drift material these formations could not be differentiated on the map. The heavier shade of color for the former represents approximately the relative position of this formation.

The Vernon red shales derive their name from the village of Vernon in Oneida county. They have been recognized as far east as Herkimer county and are well shown in many of the water courses and on the hills south of the Mohawk valley and westward. In color they are of a nearly uniform red, except for an occasional thin band of light gray. In their western extension more of the thin grayish bands appear. In a general way these shales resemble the lower red shales of the Medina and this similarity gave no little trouble to the early geologists. Like the shales of the lower Medina the Vernon shales are without fossils and salt springs are known in both, indicating that the conditions of sedimentation during which they were formed were similar.

The absence of workable deposits of gypsum in the Vernon shales is of some interest since it involves conditions which as yet have not been explained. As these beds lie below the great salt deposits of the Salina, it would be natural to assume that the increasing concentration of the sea would have precipitated gypsum before the more soluble salt. It is possible that the gypsum may be disseminated in the great thickness of Vernon shales which averages about 600 feet.

The Vernon shales are shown along the canal and adjacent to it at Pittsford. Farther east they are well exposed between Pittsford and Cartersville. Various shades of red and green of these shales can be observed at these outcrops.

The great beds of rock salt occur just above the Vernon shales,

[1] *See* N. Y. State Paleontol. An. Rep't. 1902. p. 1158.

but in the Rochester section they have never been found. Whether the edges of the salt beds extend as far north as the Rochester region is not known. The beds occur a few miles south of this region where several shafts and wells have penetrated the rock salt. It must be remembered, however, that at the time of the deposition of the salt the Salina sea was at its minimum extent and the salt beds would be restricted to a much smaller area than the Vernon shales which precede them, and hence beds of rock salt may never have extended over any of the Rochester area. Again the salt beds if they ever extended far enough north to outcrop, must have been almost completely dissolved by the action of surface and percolating waters. The presence of salt springs about the middle of the outcrop of the Salina series, extending from Syracuse westward is very suggestive of the former presence of rock salt within this area.

*Camillus shale.* These beds take their name from Camillus in Onondaga county. They contain all the workable beds of gypsum found within the State. They extend as far east as Albany county and west beyond the limits of the State. Gypsum is mined and quarried from this formation at many points from Buffalo to east of Syracuse. West, just beyond the limits of the map, the gypsum is mined at Wheatland. The most extensive beds of gypsum are at the top of the formation and, at Union Springs, are 50 feet thick including a few thin bands of shaly material.

The thickness of the Camillus shale varies considerably, but the average thickness is about 300 feet. The formation includes a number of thick layers of magnesian limestone. The shales are quite soft and in color vary considerably. They include layers of red and mottled shales, which alternate with gray and olive green shales containing thin seams of gypsum. As before stated, the only fossils noted from the Camillus shale are Leperditia scalaris and a form of Meristella. These are found in the magnesian limestones of this formation.

*Bertie waterlime.* This waterlime terminates the Salina series and is the highest formation represented on the map. The term is from Bertie, a town in Ontario, 12 miles west of Buffalo. The name was long ago applied by Chapman to the Eurypterus-bearing waterlimes of that place. The formation is known to extend from Canada as far east as Schoharie county and throughout this extent

the formation is characterized by the presence of this crustacean. In the Hudson river valley about Rosendale, the lower waterlime bed known as the Rosendale waterlime is found to occupy a similar stratigraphic position, but herein no Eurypterus has been found. The absence of these forms in the eastern section is explained by the probability that between these two areas there existed a land barrier, which prevented the migration from the Salina sea lying west of the barrier.

The Bertie waterlime varies in thickness in different sections. Sixty feet are recorded from Canada, but in some places in New York only 10 feet intervene between the gypsum beds and the Cobleskill limestone which lies just above. The portion just below the Cobleskill is the part that is burned for hydraulic cement. The hydraulic cement made in the vicinity of Buffalo and Akron is from the Bertie. In Onondaga county considerable cement is made, but from a higher horizon. The Bertie waterlime is also present in Onondaga county, but it is not used to any extent for cement.

Owing to the heavy drift covering, no outcrops of the Bertie have been observed within the region mapped. It is present, however, as shown by the adjacent sections. Just west from the southern portion of the map, this formation is found overlying the gypsum bed in the town of Wheatland. Here it has its characteristic drab color and occurs in thin layers. Some of the layers contain fragments of Eurypterus and large numbers of Leperditia scalaris are found. Large hopper-shaped salt cavities also occur here.

One mile west from Fishers, just east of the map, the Bertie waterlime is seen in the steep bank of the creek. A number of fragments of Eurypterus were collected at this point.

The presence of an extensive eurypterid fauna in this formation is indicative of physical conditions similar to those during which the Pittsford fauna lived. The formation in Erie and Herkimer counties is noted for the abundance and fine preservation of these crustaceans.

The Bertie marks the last stage of the Salina sea which was brought to a close by the invasion of the Atlantic waters.

# INDEX

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**New York State Education Department**

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# New York State Museum

JOHN M. CLARKE, Director

**Bulletin 118**

PALEONTOLOGY 18

# GEOLOGIC MAP AND DESCRIPTIONS

OF THE

# PORTAGE AND NUNDA QUADRANGLES

INCLUDING A MAP OF LETCHWORTH PARK

BY

JOHN M. CLARKE & D. DANA LUTHER

ACCOMPANIED BY A REPORT ON THE

# PLEISTOCENE HISTORY OF THE GENESEE VALLEY

BY

HERMAN L. FAIRCHILD

*New York State Education Department*
*Science Division, March 7, 1907*

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

MY DEAR SIR: I communicate herewith, for publication as a bulletin of the State Museum, geological maps on the scale of 1 mile to 1 inch, of the Nunda and Portage quadrangles, accompanied by a description of the geological structure of these regions and including also a map of Letchworth Park with its geology and a report on the Pleistocene History of the Genesee Valley in the Portage District.

Very respectfully yours

JOHN M. CLARKE
*Director*

*State of New York*
**Education Department**
COMMISSIONER'S ROOM

*Approved for publication this 9th day of March 1907*

A. S. Draper

*Commissioner of Education*

New York State Education Department

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## GEOLOGY OF THE PORTAGE AND NUNDA QUADRANGLES

### INTRODUCTION

The region whose geological structure is here described in detail is not alone celebrated in the history of New York geology for the completeness of its presentments, the uniformity of its stratigraphy and the fullness of its ancient faunas, but its human history is romantic and its scenic features singularly attractive. The Nunda and Portage quadrangles cover a territory 17 miles long from north to south and 26 miles wide, through which in winding course runs the great gorge of the Genesee river, extending from Portage down to Mount Morris, a distance of 18

miles by the stream. Along the vertical walls of the canyon the cliffs rise from 200 to 350 feet displaying the even, regular beds of the rock formations so elaborately and lucidly as to invite the attention of the geological student, while all the attendant phenomena of the erosion of the gorge and the history of this great drainage way throughout its many vacillations afford subjects of added interest. The Genesee river crossing the entire State from north to south is the line of most continuous meridional section through the geological formations of western New York. Very naturally then, when the Geological Survey of New York was organized (1836) and the fourth or western district erected (1837), the rock exposures of this stream invited immediate attention. Not only has this trunk stream cut deep into the rock strata but its contributories, Cashaqua creek, Wolf creek, Buck run, Silver lake inlet and Wiscoy creek add other means of completing the details of geological structure so that data are not lacking on every hand to solve the problems of geological history. Public attention and interest has been recently drawn to this region by the erection within its boundaries of a new public preserve — Letchworth Park — the beneficent gift to the people of the State of New York by the Hon. William Pryor Letchworth, to whose munificence and long public service the place will be a perpetual monument. This beautiful property embraces the three cataracts of the Genesee river and the banks adjoining. It is with some satisfaction that, with the aid of Mr Letchworth, we are enabled here to present a special map of this park with its geology given in detail.

## HISTORICAL

### Bibliography

The rocks and fossils of this portion of the Genesee river section have been the subject of, or have contributed freely to many of the publications of the New York survey. It is not the purpose here to review these in detail as this publication is chiefly designed to explain the accompanying maps. Students will find more or less adequate accounts of the geology and paleontology of the formations involved in the works here cited.

1 The original and fundamental documents upon the region are the Second and Fourth Annual Reports (1836, 1838) and the final report of the geologist in charge of the fourth geological district (1843), James Hall.

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PROFESSOR EBEN N. HORSFORD'S GEOLOGICAL MAP OF THE GENESEE RIVER 1838

"The accompanying map is an application of the principles of isometrical projection to geological drawings. . . The plan was conceived and the map constructed by Prof. E. N. Horsford of the Rensselaer Institute." [Hall, Second Annual Report, Fourth Geological District, 1838]

The first of these was accompanied by a perspective map (here reproduced) of the Genesee river prepared by Eben N. Horsford, assistant to Professor Hall and then a resident of Moscow.[1]

2 Palaeontology of New York, v. 5, 6, 8.

In these volumes are descriptions of many of the fossils occurring in the rocks of these quadrangles.

3 The Higher Devonian Faunas of Ontario County, N. Y. John M. Clarke. U. S. Geol. Sur. Bul. 16. 1885.

Though chiefly concerned with the stratigraphy and paleontology in a section further to the east this treatise applies to and in considerable measure was based upon the Portage group of the Genesee river.

4 Faunas of the Upper Devonian, Genesee Section of New York. H. S. Williams. U. S. Geol. Sur. Bul. 41. 1888.

5 Stratigraphic Value of the Portage Sandstones. D. D. Luther. N. Y. State Mus. Bul. 52. 1902. p. 616-32.

Traces the upper sandstones of the Upper Falls at Portage eastward and shows their continuity with the High Point sandstones of Ontario county. In the same paper J. M. Clarke shows that the fauna of this sedimentation unit is entirely different at the east from that in the Genesee valley, at the former containing a Chemung brachiopod assemblage, in the latter the typical Portage fauna with cephalopods and lamellibranchs.

6 Geologic conditions at the Site of the Proposed Dam and Storage Reservoir on the Genesee River at Portage. John M. Clarke. An. Rep't State Engineer and Surveyor for 1896, p. 106-22.

7 Naples Fauna in Western New York. John M. Clarke. pt 1. N. Y. State Geol. 16th An. Rep't. 1898; pt 2. N. Y. State Mus. Mem. 6. 1903.

This work describes and illustrates the fauna of the Portage group in its entirety, discusses its bionomic relations and elucidates the stratigraphy of the formation.

8 Stratigraphy of the Portage Formation between the Genesee Valley and Lake Erie. D. D. Luther. N. Y. State Mus. Bul. 69. 1903. p. 1000-29.

[1] Mr Horsford, after serving as a teacher at Geneseo and at Albany, became the distinguished Rumford professor of chemistry at Harvard University. The rocks and fossils of the Genesee valley have inspired other men to distinction. Maj. John W. Powell, late director of the United States Geological Survey was a native of Mount Morris, and the eminent paleontologist Prof. O. C. Marsh was born on the richly fossiliferous rocks crossing the lower Genesee and not far from its western boundary.

## Classification

The rock strata of the Genesee river section have been broadly classified and generally known under the names "Genesee," for the black shale at the mouth of the gorge, "Portage" for the shales and sandstones displayed above in the walls of the gorge, and "Chemung" for the sandstones and shales exposed in the ravines and along the river bed south of Portage to the State line, names applied at the time of the first geological survey of the State, 1837 to 1843.

In this bulletin the precise and detailed classification of these rocks defines more exactly the significance of each of these appellations, as explained under the appropriate titles. Of most commanding importance in the rock succession of this region is the series of strata historically known as the "Portage Group." To validate the integrity of this term against incursion its origin and purpose are here briefly recalled.

The name "Portage" was first used in connection with the geological series of the State by James Hall in 1840 (Fourth Annual Report on the Fourth Geological District), when describing with some detail the rock section exposed in the Genesee River gorge between Mount Morris and Portageville. The following divisions were made: Cashaqua shale, Gardeau or Lower Fucoidal group and Portage or Upper Fucoidal group.

The last division included the strata between the Table rock at the top of the Lower Portage falls and the top of the heavy sandstones above the Upper falls, an aggregate of 425 feet of which 210 feet are shales and flags, not essentially different either in lithology or fossils from the beds below the Table rock and included in the Gardeau group, except as to the presence in the upper of Fucoides verticalis.

In 1843 (Final Report on the Geology of the Fourth District, page 224), Professor Hall dropped the terms "Upper Fucoidal" and "Lower Fucoidal," and the expression "Portage or Nunda group" is employed to include "Cashaqua shale," "Gardeau shale and flags" and "Portage sandstones," no change being made in the descriptions of these members of the Portage group.

It thus appears that the word "Portage" was first used as a group term, not as the description of a member of a group or unit. It was so employed by Hall in all subsequent writings.

The introduction of the name "Nunda" as an alternative term was unfortunate and is not now easily explainable, as the town of Portage was set off from the town of Nunda, March 8, 1827, and the new town included all of the territory along the banks of the Genesee river previously lying in the town of Nunda; but in April 1846, that part of Portage township on the west side of the river with a strip taken from the town of Pike, was erected into a new town and named Genesee Falls.

Of the units composing the Portage group, the Cashaqua shale is not exposed at all within the present limits of the township of Nunda, and the Gardeau shale and flags as delimited by Hall appear in but a few small isolated exposures, the heavy sandstones (Portage sandstones) at the top being the only part of the group that can be said to be fairly well exposed in the town and only to these can the name Nunda with any propriety be applied.

The term "Portage group" has been in use for more than 60 years by students of geology and has acquired recognition by the general public as the designation of the strata between the Genesee black slate and the Chemung sandstones. Historically, logically and legitimately it is substantially fixed.

Exhaustive studies of the stratigraphy and paleontology of the rock section in the Genesee gorge have shown that Table rock at the top of the Lower falls, differs from other sandstones above and below it only by being slightly harder and more calcareous, and by a more abrupt transition to soft shale in the upper surface, the sedimentation above it up to nearly the top of the Upper falls being of the same character as the beds below it down to the mouth of Wolf creek; the same fossils occur above and below it. Therefore recent publications by this department have fixed the upper limit of the Gardeau flags at the base of the heavy sandstones near the top of the Upper falls.

To avoid the confusion by duplication of the original group term "Portage" with the later unit term "Portage sandstones," we shall here substitute for the latter the term "Nunda sandstone" as the designation for the upper terminal member of the Portage group as Hall defined it.

## Description of formations

All the geologic formations represented on the area here considered belong to the upper division of the Devonic system.

The following is the succession in descending order and the formations are considered in order from bottom to top.

| | | | | |
|---|---|---|---|---|
| Neodevonic | Chautauquan | Upper | Chemung sandstones and shales | 425[1] |
| | | Lower | | 400[1] |
| | | | Wiscoy shale | 190[1] |
| | Senecan | | Nunda sandstone | 215[1] |
| | | | Gardeau flags and shale | 344[1] |
| | | | Grimes sandstone | 25[1] |
| | | | Hatch flags and shale | 204[1] |
| | | | Rhinestreet black shale | 53[1] |
| | | | Cashaqua shale | 125[1] |
| | | | Middlesex black shale | 35[1] |
| | | | West River black shale | 65[1] |
| | | | Genundewa limestone | 8[1] |
| | | | Genesee black shale | 5[1] |

The aggregate thickness of the beds here described is 2142 feet. The difference in altitude between the Genesee river bed at the north line of the Nunda quadrangle and the highest point near the southwest corner of the Portage quadrangle is 1565 feet and 578 feet additional are brought up by the elevation of the strata toward the north and east.

## Genesee shale

The lowest rock exposure on this area is the Genesee black shale.

**Historical.** This formation was first described in the 3d Annual Report by Hall, 1839, page 301, under the title "Upper black shale," beginning, "Reposing upon the Tully limestone we have a thickness of 150 feet of shale exhibiting throughout a uniform color, and slaty structure" etc.

The black shale is mentioned several times in this report, as occurring in Seneca, Yates and Ontario counties, but no more specific name is applied to it. It is also referred to in the 4th Annual Report.

In the final report of 1843, page 218, the name Genesee slate is substituted for Upper black shale, and the opening of the gorge of the Genesee river at Mount Morris is said to be the place of its greatest development in the district.

As usually described in the annual and final reports it immediately overlies the Tully limestone or, when that is wanting, the Moscow shale, and is succeeded by the beds of greenish shale afterward given the name Cashaqua shale, but on page 422 of the report for 1839, after mentioning the localities of several exposures of the Upper black shale in the vicinity of Moscow and Geneseo, including the one at Fall brook, where it is stated " the water leaps a hundred feet from the top of this rock," Hall says: " In this neighborhood the black shale is succeeded by a stratum of thin limestone."

In the final report on the fourth geological district, page 227, where describing the Cashaqua shale he says: " On tracing it (the Cashaqua shale) west of the Genesee, it constantly presents the same features as on the Cashaqua creek, though the lower part is sometimes dark colored and separated from the Genesee slate by a thin calcareous band," evidently referring to the limestones at the top of the falls at Fall brook and in the ravine of Little Beards creek at Moscow which also appear in all exposures of this horizon between Ontario county and Lake Erie, and are now known as the Genundewa limestones, more fully described in the succeeding pages. That it is the stratum referred to by Hall is made certain by the fact that there is no other continuous limestone above it in the Genesee river section, nor elsewhere in this State west of Ontario county.

There are 83 feet of Genesee black shale between the horizon of the Tully limestone and the Genundewa limestone at Fall brook and 100 feet of dark and black shales between the Genundewa limestone and the base of the Cashaqua shale at the mouth of the gorge. The latter beds have been commonly known as Upper Genesee, but the difference in the character of the shale above and below the Genundewa limestone, and in their faunas, has made it proper, as further explained in New York State Museum bulletin 63, page 25, to restrict the use of the name " Genesee " to the beds between the horizon of the Tully limestone and the Genundewa limestone.

As thus defined the only exposure of this formation on these quadrangles is at the west end of the highway bridge over the Genesee river at Mount Morris in the lower part of a small outcrop on the north side of the bridge. At times of low water the exposure is 15 to 20 feet long and 6 to 8 feet high.

The shale here is very dark, but somewhat more calcareous and less bituminous than the beds below, which are, for the most part, densely black and on exposure become very fissile and split into

large flat plates. Spherical concretions are common throughout the Genesee shale.

Fossils are very rare in this formation, specially in the more bituminous beds. Drifted land plants and conodont teeth sometimes occur in the black shale, and the more calcareous layers toward the top contain:

| | |
|---|---|
| Pleurotomaria rugulata *Hall* | Orbiculoidea lodensis (*Vanuxem*) |
| Styliolina fissurella (*Hall*) | Liorhynchus quadricostatus *Hall* |
| Pterochaenia fragilis (*Hall*) | Probeloceras lutheri *Clarke* |
| Lingula spatulata *Hall* | Bactrites aciculum (*Hall*) |

The entire section of the Genesee slate is well exposed in several ravines north of Moscow and in the Fall brook ravine at Geneseo below the top of the falls and in numerous other localities along its line of outcrops, which extends from Chenango county to Lake Erie.

### Genundewa limestone

The stratum of impure limestone referred to by Hall as succeeding the Genesee slate in the vicinity of Moscow and Geneseo, is the heaviest of a series of similar character that seems to have escaped farther notice until 1882, when it was described by Clarke, in United States Geological Survey bulletin 16, as the "Styliola band."

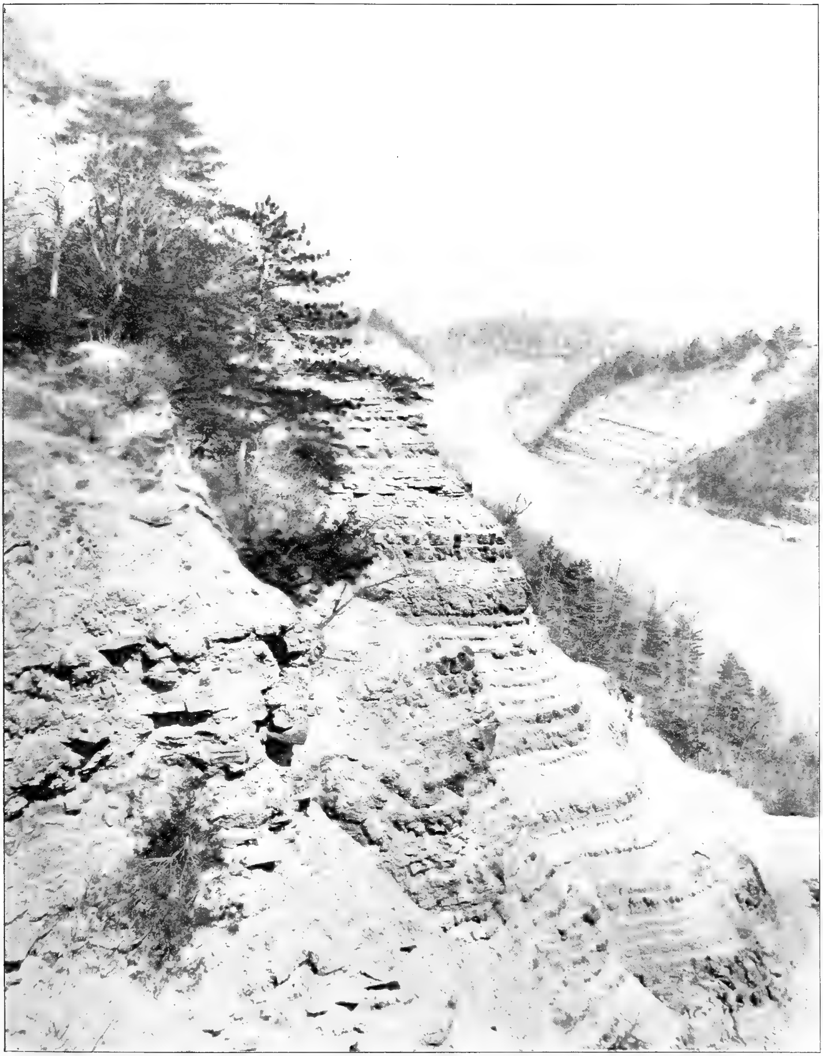
In New York State Museum memoir 6, *Naples Fauna in Western New York,* pt 2, Clarke, 1903, and in Bulletin 63, Clarke and Luther, 1904, it is more fully described as a unit of sedimentation in the Genesee beds and designated Genundewa limestone on account of its very favorable exposure at Genundewa Point on the east side of Canandaigua lake.

This horizon is quite calcareous and concretionary as far east as Cayuga lake, but the limestone first appears as distinct layers in Gorham, Ontario co., when westward it is continuous to Lake Erie, its peculiar structure making it easy of recognition wherever exposed.

In the Genesee valley region it is composed of five layers of dark gray bituminous limestone from 2 to 14 inches thick separated by layers of dark shale from 1 to 6 inches thick. Some of the limestones are even and flaggy, while others are concretionary and the laminations of the intervening shale are bent to conform with their very uneven surfaces.

The entire band was formerly exposed at the west end of the Pennsylvania Railroad bridge over the river at Mount Morris,

## Plate I



View of lower part of the Genesee gorge from the High banks. Looking toward the northeast. Rhinestreet black shale in front; lower part of cliff in distance is Cashaqua shale

but since the erection of the dam below it only appears at the west end of the highway bridge immediately north of the dam, where the lower layers may be seen above the outcrop of black Genesee slate previously mentioned.

Fossils are abundant and peculiar, the purer limestone being composed almost wholly of the minute shells of the pteropod Styliolina fissurella (Hall) and the entire fauna has very close relations with that peculiar to the Portage beds above. It is the earliest appearance in New York of the Naples fauna or the world-wide zone of Manticoceras intumescens.

The following are common species, but for the full list with descriptions and illustrations consult *Naples Fauna in Western New York,* pt 1 and 2.

| | |
|---|---|
| Manticoceras pattersoni (*Hall*) *var.* styliophilum *Clarke* | Honeoyea styliophila *Clarke* |
| Gephyroceras genundewa *Clarke* | Buchiola retrostriata (*v. Buch*) |
| Tornoceras uniangulare (*Conrad*) | Pterochaenia fragilis (*Hall*) |
| Phragmostoma natator *Hall* | Aulopora annectens *Clarke* |
| | Melocrinus clarkei *Williams* |

In the vicinity of these quadrangles favorable exposures of the Genundewa limestone may be found in several ravines along the west side of the Delaware, Lackawanna and Western Railroad between Moscow and Greigsville, also at the top of the falls in the Fall brook ravine at Geneseo and along the east and west road ¾ miles south of the same falls.

It causes cascades in many ravines in Livingston and Ontario counties and is well exposed in the bed of Murder creek at Griswold, Wyoming co.

### West River shale

A bed of dark to black shale about 100 feet thick succeeds the Genundewa limestone in this section. The lower part is covered by the water above the Mount Morris dam but the upper part is finely exposed in the cliff on the east side of the mouth of the gorge.

For about 62 feet next above the limestone the shales are mainly dark gray or blue black with thin layers of densely black and slaty bituminous shale 4 to 6 inches thick occurring at intervals of 2 to 6 feet, producing in this and other cliffs of these beds a distinct banded effect.

These shales are contrasted with the Genesee shale below by their generally lighter color and less bituminous character. They are also more fossiliferous, though the number of species repre-

sented is but slightly increased by the addition of a few of the forms that first appear in the Genundewa limestone.

The following are the more common fossils:

| | |
|---|---|
| Bactrites aciculum (*Hall*) | Buchiola retrostriata (*v. Buch*) |
| Pleurotomaria rugulata *Hall* | Lingula spatulata *Vanuxem* |
| Pterochaenia fragilis (*Hall*) | Orbiculoidea lodensis (*Vanuxem*) |

Spheric and oblong concretions occurring singly or in rows are common and have been collected in many places on account of their symmetry or their sometimes curious forms suggestive of "petrified turtles," "Indian skulls," "stone hats," "stone ducks" etc.

No exposure of these beds but the one at the mouth of the gorge, which is continuous up the river for about a mile, is found on these quadrangles, but they may be seen to good advantage above the falls in the Moscow ravine, 3 miles farther north and in the upper part of the Fall brook gully.

The name "West River shales" was first applied to these beds above the Genundewa limestone by Clarke and Luther in Bulletin 63, 1904, on account of their abundant exposure in the ravines of the West river valley in Yates county and to meet the requirements of a stratigraphic term for the residuary member of the old Genesee division.

### Standish shale

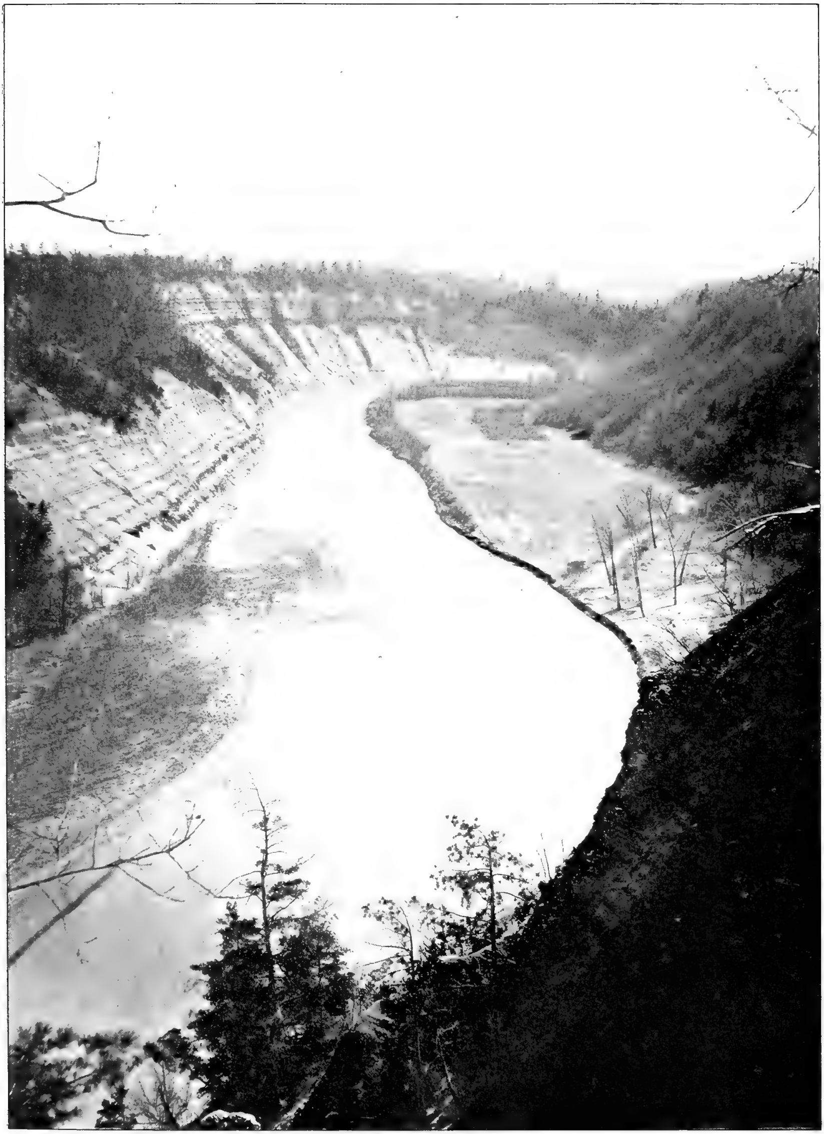
At the top of the West River beds there are in this section a few lighter colored layers, some clayey, others slightly arenaceous, altogether about 3 feet in thickness.

This lighter band which has the lithic characters of the shales and flags of the Portage group and contains a few fossils from both the Genesee and Portage faunas, is hardly noticeable here, is more fully developed in the Canandaigua lake valley and is known as the Standish shales and flags. It is not represented in the coloring on this map.

### Middlesex shale

This passage bed is succeeded by 32 feet of densely black bituminous slaty shales that show a marked contrast to the West River shales lithologically and in being almost entirely barren of fossils except lignites, which are common, and a few fish plates and scales, which are very rare. A few small lingulas found in this horizon at the mouth of Pike creek on Lake Erie are the only other fossils collected from these beds in the western part of the State and they belong to the species found in similar black shales higher in the Portage group, L. ligea Hall and L. spatulata Vanuxem.

Plate 2



Cashaqua beds in the river gorge near Mount Morris. Upper part of cliff in distance. Rhinestreet black shale

In the early reports of the Geological Survey this black shale band was considered as the upper part of the Genesee black slate. In United State Geological Survey bulletin 16, 1885, J. M. Clarke, for the reasons above stated, separated it from the Genesee slate and considered it as a member of the Portage group under the name "Lower black band." In New York State Museum bulletin 63, 1904, it was designated the Middlesex shale, from its abundant exposures in the town of Middlesex, Yates co., from which locality it is continuous westward maintaining its general characteristics, but diminishing in thickness to 6 feet on the shore of Lake Erie, where it is well exposed in the bed of Pike creek near its mouth in the town of North Evans, Erie co.

The exposure of the Middlesex black shale in the cliff at the mouth of the gorge is continuous in both banks for about 2 miles, the dip bringing it down to the river level on the south side of the "Hogsback." Other outcrops may be seen in the lower part of the ravine 2 miles northwest of Mount Morris, at the mouth of Buck run ravine, and on Cashaqua creek at the foot of the cliff at Sonyea.

## Cashaqua shale

The beds included in this division were first described in the Third Annual Report on the Fourth District, 1838, as they appear succeeding the Genesee black slate in Yates and Seneca counties.

The name Cashaqua shales first appears on page 390 of the Fourth Annual Report on the Fourth District for 1839, where it is said: "The group mentioned in the report of last year as succeeding the upper black slate, becomes on the Genesee a mass of green crumbling shale of 110 feet thickness. It is exposed on Cashaqua creek, hence the name Cashaqua shale."[1]

In the final report of 1843, pages 226 and 227, after more fully describing this division as it appears in the Genesee section, it is added: "At the eastern extremity of the district and on the shores of Seneca lake at Penn-Yan and other places, this rock consists of a green shale with thin flagstones and interlaminated sandy shale. It contains the same fossils; and holding the same position as on the Genesee it can be regarded only as the same rock. . . . Farther east it is not recognized as shale at all, the mass consisting of thinly laminated sandstones." Tracing it west of the Genesee, it con-

[1] This Indian name derived from Gah-she-gwah, a spear, is also spelled Coshaqua, Kishaqua, Kushaqua, Keshequa and Keshaqua. It is retained here in the form used by Hall which is the spelling adopted in the geological literature of New York for 70 years. The word is pronounced *Kish-e-quay.*

stantly presents the same features as on the Cashaqua but thins down to 33 feet on the shores of Lake Erie.

The passage from the Middlesex to the Cashaqua shale is through several alternations of light and dark layers in a few feet above which horizon the black layers are infrequent and thin. They reappear toward the top and after a few alternations like those at the base become the homogeneous mass of black shale constituting the Rhinestreet black shale, the succeeding member of the Portage group. Fossils are not abundant in any part of the Cashaqua shale, but a few may be found in all of the lighter beds and in the upper and more calcareous olive shales they are fairly common. Some large cephalopods are finely preserved in flat concretions 20 to 40 feet below the top of the formation.

Concretions usually a foot or more in diameter in a row at the top of these shales in this section and further east have a layer of calcareous matter 1½ to 2 inches thick at the base composed of fossils, sometimes in fine condition.

This is approximately the horizon of the Parrish limestone, a thin calcareous layer of concretionary structure, continuous from Canandaigua lake valley to Seneca lake and a reliable datum point in the stratigraphy of that region.

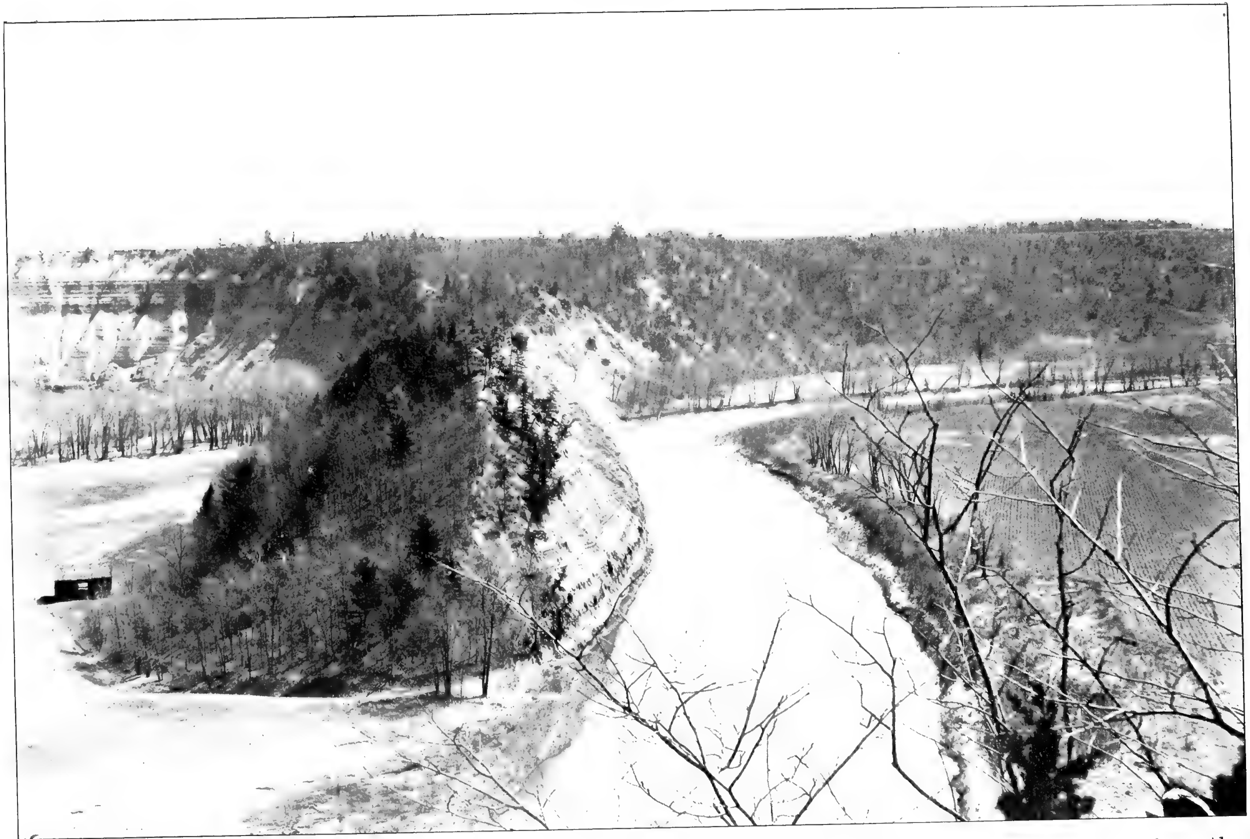
The fauna of the Cashaqua shale is diverse and interesting. This horizon is the normal seat of the peculiar fauna of the Portage group, which is continued eastward without much variation but at the west shows differences of composition [*see* Clarke, Naples Fauna of Western New York].

In the general section the more common forms are:

Manticoceras pattersoni (*Hall*)
Probeloceras lutheri *Clarke*
Tornoceras uniangulare (*Conrad*)
Bactrites aciculum (*Hall*)
Orthoceras pacator *Hall*
O. ontario *Clarke*
O. filiosum *Clarke*
Phragmostoma natator *Hall*
Lunulicardium (Pinnopsis) acutirostrum *Hall*
L. (Pinnopsis) ornatum *Hall*
Pterochaenia fragilis (*Hall*)
P. cashaqua *Clarke*
Honeoyea major *Clarke*
Ontaria suborbicularis (*Hall*)
O. accincta *Clarke*
Buchiola retrostriata (*v. Buch*)
Paracardium doris *Hall*
Palaeoneilo petila *Clarke*
Lingula ligea *Hall*
Aulopora annectens *Clarke*
Melocrinus clarkei *Williams*

The Cashaqua shale is exposed in the walls of the gorge from near the mouth where the base is seen over the black beds for 6 miles to the north end of Smoky Hollow where the southwestern dip brings it down to the river level. Opposite the lookout stations along the "High Banks" where the cliffs are 300 to 350 feet high,

Plate 3



View of the "Hog-back" at bend in Genesee river $2\frac{1}{2}$ miles above Mount Morris dam; looking east from the High banks. The ridge is composed of Cashaqua shales, capped by black Rhinestreet shales

the formation is displayed in a most striking manner, as a heavy band of light blue gray in the middle of the wall contrasting strongly with the black bands above and below it.

The mass of the unique "Hogback" is composed of this shale capped by the black Rhinestreet shale.

The ravine at Gibsonville affords an excellent opportunity for examination of the upper beds and good exposures of the entire formation may be found in the ravine 1 mile west of the mouth of the gorge; in Buck run ravine, 1 mile southeast of Mount Morris; along Cashaqua creek for 2 miles south of Sonyea, and on the east side of the Canaseraga valley in the large ravines nearly opposite Sonyea. The smaller ravines on both sides of the valley present many good exposures of the upper beds and the contact with the Rhinestreet shale appears at the roadside on the hill 1¼ miles southeast of Groveland station, near the east line of the Nunda quadrangle.

### Rhinestreet black shale

The Cashaqua beds from Schuyler county on the east to Lake Erie are succeeded by a band of black shale with a few thin lighter and mostly arenaceous layers intercalated at some localities altogether differing materially in both structure and fauna from the Gardeau group in which it was formerly included as described in the reports of the Geological Survey of the fourth district. Its strong contrast with the light blue Cashaqua beds below it, and the flags and sandy ferruginous shales above it, makes it a distinct and noticeable feature in the stratigraphy of western New York. It was referred to by Clarke in United States Geological Survey bulletin 16, as the "Second Black Band" in the Portage group. In New York State Museum bulletin 63, it is described as a Portage unit, and on account of its constant exposure in the vineyard region north of Naples known as "Rhinestreet" the name here used was applied to it.

It is 21 feet thick at Naples, but increases toward the west at an average rate of about 2 feet per mile and on Lake Erie has a thickness of 185 feet. In the Genesee river section the assigned thickness is 53 feet.

Fossils, except lignites, fish remains, conodont teeth and occasionally a Spathiocaris and a few small lingulas are almost entirely absent from these beds. The lighter interlaminated shales at the top and bottom occasionally contain specimens from the Cashaqua fauna.

The Rhinestreet black shale is finely displayed in the walls of the gorge from the top of the north end of High Banks continuously for 8 miles southward to the north end of the St Helena or Gardeau Flats.

It is the cap rock of the "Hogback" and is finely exposed at Gibsonville, also on Buck run at and above the cascade and in adjacent ravines; on Cashaqua creek for a mile midway between Sonyea and Tuscarora; and in the ravine 2 miles northwest of Mount Morris.

On the east side of the valley it appears in several ravines 1 to 3 miles north of Groveland station and in the rock cut of the Delaware, Lackawanna and Western Railroad, 1½ miles southeast from Groveland station. Very fine fish remains have been collected from this locality.

The list of fossils contained in the Rhinēstreet black shale comprises the following species:

Palaeoniscus devonicus *Clarke*
Pristacanthus vetustus *Clarke*
Acanthodus pristis *Clarke*
Polygnathus dubius *Hinde*
Prioniodus spicatus *Hinde*
P. erraticus *Hinde*
Spathiocaris emersoni *Clarke*
Lingula ligea *Hall*

## Hatch flags and shale

In the rather meager description of the "Gardeau flagstones and shales" in the reports on the geology of the fourth district some reference is made to the difference between the character of the lower and upper beds of the division.

This difference is more manifest in the Naples section specially in regard to the faunas and the horizon of the change is marked by a series of heavy sandstones that have produced an escarpment on Hatch hill 275 feet above the Rhinestreet shale as exposed at the foot of the hill.

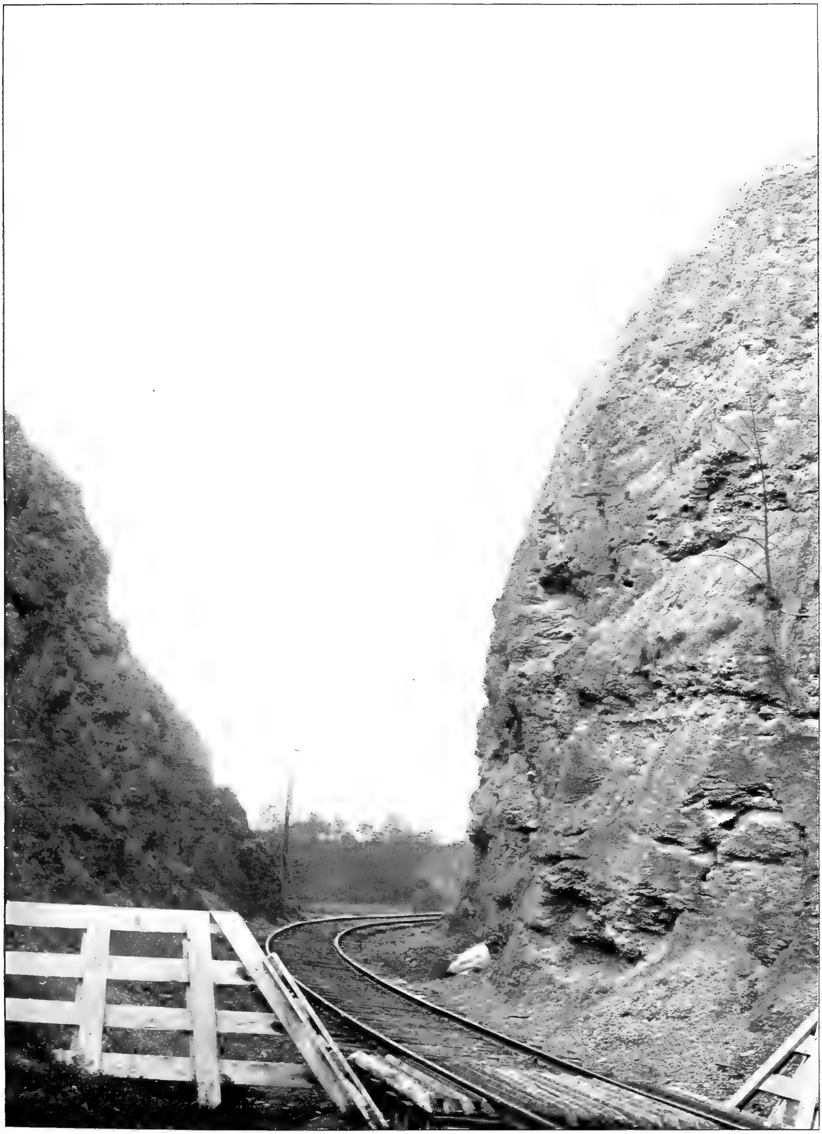
In State Museum bulletin 63, the intervening shales and flags between these sandstones and the Rhinestreet shale were fully described and designated the "Hatch flags and shale."

In the Genesee section the formation is included between the Rhinestreet black shale and the bank of thin sandstones that is seen in the cliff on the east side of the Gardeau Flats, coming down to 60 feet above the river at the east end of the St Helena bridge and to the river level at the mouth of Wolf creek, embracing 209 feet of shales and flags. The shales are in thin layers many of them being black and slaty, others blue and fissile or olive, coarse and sandy. The general aspect of the rock walls in this part of the

Plate 4

Southeast side of the "Hog-back." The contact of the Cashaqua shales and the overlying Rhinestreet black shales is distinctly shown

Plate 5



Rock cut in Cashaqua shales. Cashaqua creek

gorge is made dark and rusty by the ferruginous characters of the coarser shales and sandstones.

The flags in these beds are smooth and even on the lower surface except for the presence of casts of depressions in the soft mud beneath, on which they were deposited in the shape of short straight ridges lying at all angles. These bodies have been known as Fucoides graphica. The upper surface of the flags is usually shaly. Fossils except plant remains are very rare, though some of the lighter colored shales in the lower part contain:

Manticoceras pattersoni (*Hall*)
Probeloceras lutheri *Clarke*
Orthoceras pacator *Hall*
Phragmostoma natator *Hall*
Ontaria suborbicularis (*Hall*)
Palaeotrochus praecursor *Clarke*
Buchiola speciosa (*v. Buch*) and a few other forms.

Besides the exposure of these Hatch beds for 8 miles in the cliff along the river from opposite Gibsonville to the mouth of Wolf creek, they may be seen along the Silver lake outlet 2 miles below Perry; in the upper part of the ravine 2 miles northwest of Mount Morris; along Buck run above the falls to the first highway bridge; on Cashaqua creek and at Tuscarora a mile below; also in the ravines at West Sparta and in nearly all of the ravines on the east side of the Canaseraga valley within the limits of the Nunda quadrangle.

### Grimes sandstone

At the mouth of Wolf creek a band of thin sandstones separated by hard dark shales, altogether about 25 feet thick, overlying the Hatch flags and shales comes down to the bottom of the cliff. It is 60 to 85 feet from the base of the cliffs at the east end of the St Helena bridge and is prominent in the eastern rock wall opposite the Gardeau Flats, 1 to 2 miles below St Helena.

It is here essentially barren except for plant remains, and it is not a very well defined nor significant feature of the Portage section on the Genesee river or further west, but toward the east in the Springwater and Naples valleys the sandstones are much heavier and contain brachiopods and other forms not found in the Portage beds of the western part of the State, though most of them are common in the "Ithaca" beds of this horizon and that of the Hatch flags and shales in Tompkins county and farther east.

At Naples the characteristic lamellibranchs and many of the other forms composing the Naples fauna that occur more or less abundantly up to the base of this band have not been found above it.

This formation was first described as a member in the Portage

group in State Museum bulletin 63, and designated Grimes sandstone from its exposure in Grimes gully at Naples, N. Y.

Other outcrops of these sandstones may be seen in several small ravines west of Smoky Hollow and on the Silver lake outlet 1½ miles below Perry, also in the gullies north of Groveland station and south of West Sparta.

### Gardeau flags and shale

As considered in this bulletin, this formation consists of an extensive series of flags or thin sandstones and shales occupying that part of the river section between the Grimes sandstone at the mouth of Wolf creek and the base of the heavy sandstones at the top of the Upper falls, with an aggregate thickness of 344 feet.

These rocks constitute the most striking part of this famous canyon. On the south side of the mouth of the Wolf creek ravine the vertical cliffs rise 250 to 300 feet in which the bands of black, blue gray and olive shales, and the greenish or blue sandstones of varying thicknesses and in irregular succession are displayed in the most effective manner.

The lower beds, principally shales, are accessible in times of low water in the lower part of the Wolf creek ravine, and some of the lighter colored layers are fossiliferous.

Midway in the cliffs for 2 miles south of Wolf creek the even stratum of sandstone that is the platform of Table rock at the top of the Lower falls, 70 feet high, is seen. Below this stratum down to the bottom of the falls, there are five layers of black shale aggregating 9 feet in thickness, intercalated at irregular intervals in 57 feet of gray shale and a few thin flags. Above it the sandstones are more frequent and increase in thickness, and in the walls below the Middle fall compose a considerable portion in the sedimentation. They are mostly not more than a foot or two in thickness, however, and layers of both light and dark shales recur up to the top of the formation.

In the broad slope of rock on the west side of the river extending from the top of the Middle to the bottom of the Upper falls 19 feet of shales and flags are accessible and 20 feet more on the west side of the waterfall can easily be reached.

For 51 feet above the bottom of the Upper fall the rock is principally soft with seven thin layers of dark or black shale interstratified between light shales or thin flags. One stratum of rather shaly sandstone 2 feet, 5 inches thick is 19 feet above the base of the section and is separated from a similar but slightly more com-

Plate 6

Gorge below Lower falls, Glen Iris. Gardeau flags and shales

Plate 7

Cathedral rock, below the Flume, Glen Iris. Gardeau flags and shales

pact layer 3 feet, 6 inches thick by 5 feet, 4 inches of soft shale mostly dark.

This sandstone is succeeded at the top of the formation by 19 feet, 8 inches of light and dark shales with a few thin flags, overlain by the stratum of light blue gray sandstone 7 feet thick that is the basal layer of the next higher member of the Portage group, the Nunda sandstones. The Gardeau flags and shales are the lowest rocks exposed on the Portage quadrangle in the Oatka creek or Warsaw valley. In the large ravine of Stony creek or Fall brook, ½ miles southwest of Warsaw 235 feet of these beds are finely exposed below the Erie Railroad. They are, as a whole, noticeably softer than in the Genesee river section and there are fewer sandstones except at the top of the falls, where a hard stratum 1 foot thick has been denuded of shale for the space of a few square rods, and is locally known as Table rock. It is not, however, in the same horizon as the Table rock at the Lower Portage falls.

In Gibson's glen, near South Warsaw, 150 feet of the upper beds are exposed, and a somewhat less thickness of the same up to the top of the formation in the ravine of Oatka creek between Newburg and Rock Glen.

In the Nunda or Cashaqua creek valley the small ravines on the side of East hill opposite Nunda and on the west side below Brooks grove, show partial sections of these beds, and Wildcat gully cuts through the entire formation.

The upper parts of the rock gullies on the west side of the Canaseraga valley above West Sparta and nearly up to Byersville are in the Gardeau beds, and they are exposed under similar conditions on the east side above Groveland station.

The fauna of the Gardeau beds on these quadrangles is not an extensive one, but it is made specially interesting by the fact that it is composed of several species that first appeared in the Genundewa limestone and were more or less common in the Cashaqua, with additions from the Portage fauna on Lake Erie, and, east of the river, some members of the Ithaca fauna that do not appear in the exposures in the gorge, nor in this horizon further west.

Fossils except plant remains are usually almost entirely absent from these sandstones on the Portage quadrangle but Table rock in the Fall brook ravine, Warsaw which is in two parts, separated by a thin seam of shale, bears on the surface of the lower part scores of the little lamellibranch Buchiola retrostriata and several other species abundantly. Some flattened concretions in a

bed of soft shale at the mouth of Gibson's glen contain some beautifully preserved fossils, mostly small specimens of Manticoceras rhynchostoma Clarke and similar concretions occur elsewhere in this horizon but by far the larger part of the fossils collected from the Gardeau beds have been found in layers of light blue or olive soft shale, generally but a few inches thick. But few of them are conveniently accessible to collectors, but the lower one may be reached at the mouth of Wolf creek and others a mile farther up the ravine.

At the top of the Lower Portage fall, a 10 inch layer immediately beneath Table rock is quite fossiliferous and a thinner layer 10 feet lower contains a few lamellibranchs and Manticoceras rhynchostoma occurs though very rarely, just above the 12 inch sandstone at the top of the Flume.

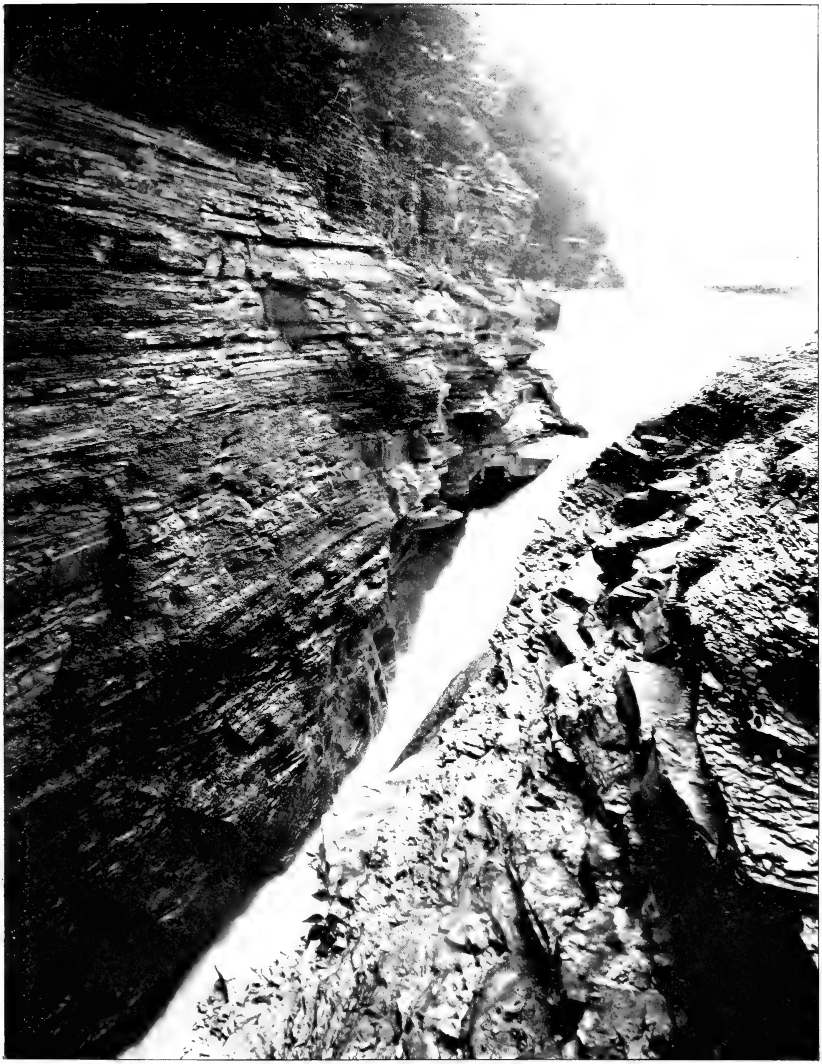
In 1906 a fall of rock from 60 feet up in the cliff on the east side 40 rods above the Lower fall, brought down a part of an extensive bed of plant remains in which were many fragments of lepidodendron. A thin layer at water level half way between the Middle and Upper falls has afforded a number of fine specimens of Manticoceras oxy Clarke and other species, while similar layers occur a few feet higher.

Although no brachiopods have been found in these beds in the gorge it is quite possible that some of the considerable number common in this horizon in the Naples valley may have extended as far west as this and their remains be buried in the inaccessible strata of the cliffs. A thin calcareous seam exposed by the roadside on Quarry hill 1 mile south of Nunda and stratigraphically near the top of the Gardeau beds, is composed of crinoid stems and fragments of brachiopods, and a calcareous sandstone 3 inches thick exposed by the side of the river road 2 miles north of River Road Forks and in the lower part of this formation contains Ambocoelia in large numbers, also Chonetes and fragments of Leptostrophia less abundantly, all exceedingly small.

The following is a list of the more common fossils in the Gardeau beds on these quadrangles:

Entomis serratostriata *Sandberger*
E. variostriata *Clarke*
Manticoceras pattersoni (*Hall*)
M. oxy *Clarke*
M. rhynchostoma *Clarke*
Tornoceras uniangulare (*Conrad*)
Orthoceras pacator *Hall*
Bactrites aciculum (*Hall*)
Styliolina fissurella (*Hall*)
Phragmostoma natator *Hall*
Loxonema multiplicatum *Clarke*
Palaeotrochus praecursor *Clarke*
Lunulicardium bickense *Holzapfel*
Honeoyea erinacea *Clarke*

Plate 8



Lower falls and "Flume," Glen Iris. Gardeau flags and shales

Plate 9

Part of the Lower falls at Portage from Table rock. Gardeau flags and shales

H. major *Clarke*
H. desmata *Clarke*
Posidonia attica (*Williams*)
Ontaria suborbicularis (*Hall*)
O. clarkei (*Beushausen*)
Euthydesma subtextile *Hall*
Buchiola retrostriata (*v. Buch*)
B. lupina *Clarke*
Paracardium doris *Hall*
Pterochaenia fragilis (*Hall*)
Cladochonus
Lignites
Fucoides graphica *Hall*
F. verticalis *Hall*

### Nunda sandstone

A stratum of sandstone 7 feet thick, the bottom of which is 28 feet below the top of the Upper fall is the basal layer of this subdivision. It is succeeded by 7 feet of shales and thin flags, overlain by the somewhat shaly sandstone 13 feet, 6 inches thick seen at the crest of that fall.

A bed of hard blue shale 4 feet, 4 inches thick overlies this sandstone, another 12 feet higher is 2 feet thick and a third 70 feet above the top of the falls is 6 feet thick with an 8 inch layer of sandstone in the upper part.

Except these three beds of shales and a few thin shaly partings between the heavy layers the formation as exposed in the Genesee river gorge section is composed entirely of light blue gray sandstone in layers from 3 to 10 feet thick, some of which are calcareous to a greater or less degree, and hard, while others are schistose or coarsely shaly in many laminations. Large and usually obscurely defined concretions or burls occur in some of the layers.

The cliffs at Portageville by long exposure have weathered to a yellowish or olive-gray color, and that is commonly the color of these beds in old outcrops everywhere, but when newly quarried the rock has a handsome blue gray tint and is popularly known as "bluestone." The more compact layers are extensively quarried on the west side of the river 1½ miles south of Portageville by the Portageville Bluestone Co., and at Bluestone by the Genesee Valley Bluestone Co., and near Rock Glen by the American Bluestone Co., and the Warsaw Bluestone Co., sawed into flagging and house trimmings, the handsome color of the rock combined with its durable character making it extremely popular for such use and of considerable importance economically.

The 6 foot bed of shale seen at the line of the Pennsylvania Railroad at the south end of the high Erie Railroad bridge, contains large numbers of small irregularly shaped calcareous concretions that give the bed a distinctly nodular expression not seen in shales east of these quadrangles but common in the western part

of the State. This band appears in the quarries at Portageville and also at Rock Glen, and may serve as a datum by which to determine the place, in the series, of the more valuable quarry stone layers. It may be seen on Quarry hill at Nunda at the reservoir. A thinner layer of the same character appears high up in the quarry wall here, but it thins out toward the west and is scarcely noticeable in the river gorge. The nodules are common also in the 2 feet of shale near the bottom of the formation at Portageville.

Next to that of the gorge section and the quarries mentioned the best exposure of the Nunda sandstone on these quadrangles is on Quarry hill 1 mile south of Nunda and along the road to Dalton. It crops out occasionally on the hill east of Nunda along the wall to Byersville and in small ravines and is well displayed in Wildcat gully in the northeast corner of the town.

It is exposed along Wolf creek below Castile and for a mile west of the Erie Railroad along Relyea creek and Stony creek near Warsaw.

Lignitic plant remains are common in the sandstones, sometimes in sufficient quantity as to form thin coaly seams of small extent. The lignites are usually fragmentary and rarely well enough preserved to allow identification of species.

Manticoceras oxy Clarke, M. rhynchostoma Clarke, Aulopora, Orbiculoidea sp. Crinoid stems, Fucoides verticalis and a few small representatives of the Gardeau fauna, constitute the fauna of this formation in the river section, but in the eastern part of the Nunda quadrangle thin seams of the comminuted shells of brachiopods occur and in the Naples valley these rocks contain a well developed Chemung fauna.

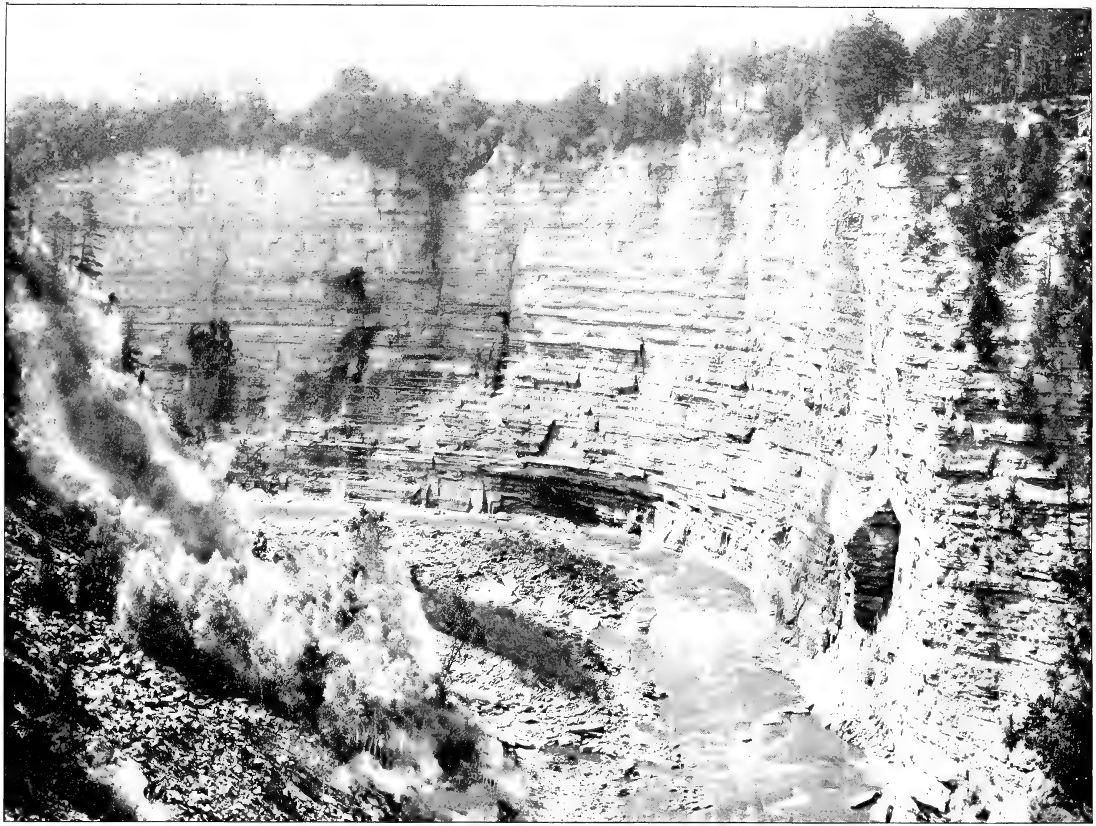
The Nunda sandstones are prominent in the stratigraphy of western New York from Chemung county to Lake Erie. The formation, while retaining its character as a mass of homogeneous barren sandstones, thins out rapidly west of Wyoming county and on the shores of Lake Erie south of Portland harbor where it dips under the water it is but a few feet thick.

Toward the east it becomes gradually less homogeneous and more assimilated to the adjacent formations, but may be traced in numerous outcrops as far east as Chemung county. In the vicinity of Naples these sandstones contain calcareous masses of fossils, mostly belonging to the fauna of the Chemung rocks. One of these outcropping in High point, a rock bluff 3 miles west of the village,

Plate 10

Upper end of Lower falls, Portage. Gardeau flags and shales

Plate 11



The gorge between the Middle and Lower falls. The rock wall is a little more than 200 feet high. Gardeau flags and shales

contains 22 species of brachiopods among them Spirifer disjunctus Sowerby, besides many other forms, and another lentil 3 miles south is a mass of fossil sponges and Chemung brachiopods, forms that did not appear in the Genesee valley section till after more than 200 feet of sediment had been deposited above this horizon. The sandstones at the top of the formation here pass gradually into soft sandy shales. The exact point of contact with the succeeding formation is covered at Portageville but is slightly exposed by the side of the Quarry hill road 1½ miles south of Nunda. The strata included in the Nunda sandstones as considered in this bulletin have an aggregate thickness of 215 feet.

In various recent publications the singularly interesting fact has been brought to notice that an essential difference in classification of the upper rocks of this Devonic series results from the independent consideration of the stratigraphic and the paleontologic evidence. In paleontology the Portage group here extends upward to include a mass of olive shales with some sand having a thickness of several hundred feet, and the upward extent of this fauna in the Genesee section is characteristic of its range throughout the region farther west in the State. But at the east, in the Canandaigua-Naples meridian, this fauna disappears practically or entirely at a horizon below that of the Nunda sandstones. These sandstones have been traced almost foot by foot between these meridians, and the stratigraphic continuity of the Nunda sandstones of the Genesee section with the High Point sandstone of the Naples section is beyond question. The seeming inappropriateness of a twofold designation for the same geologic horizon is dispelled by the entire difference in the contained faunas at these distant sections. In paleontology the High Point sandstones carrying a brachiopod fauna with Spirifer disjunctus are of Chemung age, the Nunda sandstones of Portage age. We therefore have in the Nunda sandstones of the Genesee valley a member of the Portage group which lies at the base of the Chemung group farther east. Another and still higher member of the Portage group is also present in this section and its presence and probable value were indicated by Hall in 1839 [Annual Report, p. 392].

The two groups just described (Gardeau and Portage) occupy a thickness of more than a thousand feet and are interposed between the Cashaqua shale and the Chemung group. Indeed, if we consider the Chemung group as commencing with the occur-

rence of its characteristic marine fossils, then several hundred feet more of rocks may be noticed as intervening between the upper Portage rock and that group. The rock succeeding the upper Portage rock consists of greenish olive, sandy shale, or very shaly sandstone, never slaty. The only fossils seen in this rock is a species of fucoides with a striated surface, and these are by no means numerous. This is succeeded by a dark, nearly black sandy, highly micaceous shale with septaria. It contains iron pyrites and where exposed is of an iron rust color externally. Some thin masses of gray sandstone are interstratified which contain fossils referable to the Chemung group.

[p. 402] Succeeding the black micaceous shale are the sandstones and shales constituting the Chemung group which is everywhere visible in the ravines and banks of streams. Its northern limit extends through the southern part of the towns of Centerville, Hume, Grove and Burns. In this county more particularly along the Genesee river and west, the group differs in lithological characters and consequently in some degree from the same rocks in Steuben and Chemung.

From these quotations it is clear that though Hall conventionally classified all of the rocks succeeding the Portage (Nunda) sandstones for a thickness at least as great as appears on these quadrangles, as belonging to the Chemung group, he directed attention to the fact that they might be subdivided as follows:

1 Olive shales and shaly sandstones at the base.

2 Micaceous shales with thin sandstones containing brachiopods.

3 Heavy sandstones and shales which, lithologically are very similar in character to the strata referred to as constituting the Chemung group at the type locality.

Sufficient data have not yet been obtained on which to decide whether divisions 2 and 3 should be considered as separate geological units, but it is not improbable that further invesigations may demonstrate that they are such.

The beds of division 1 are known as the

## Wiscoy shales and sands

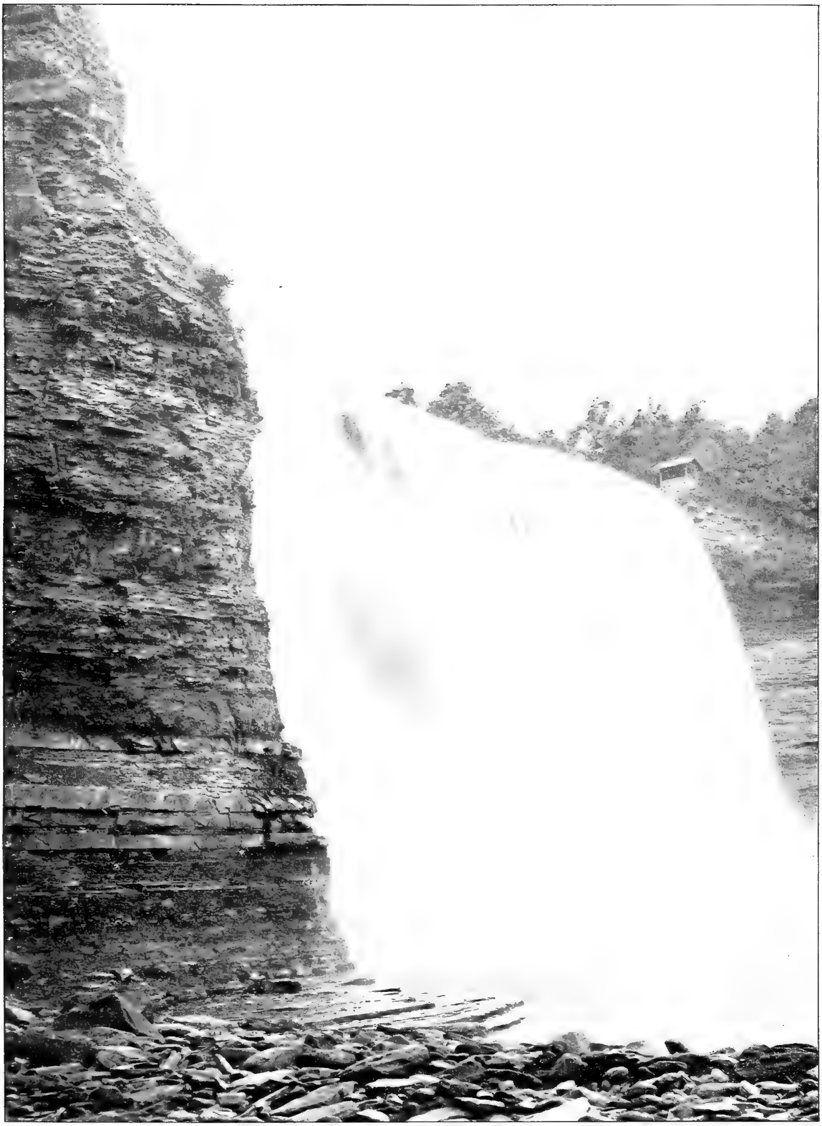
These shaly olive beds were described as a unit in the New York geological series, and the relations of the fossils found in them discussed by Clarke in the 16th Annual Report of the State Geologist of New York, 1898, and the name " Wiscoy shales and sands " applied to them on account of their favorable exposure at the falls of Wiscoy creek at Wiscoy, N. Y.

The stratigraphy of these beds was shown in detail in diagrams accompanied by description, by Luther in New York State Museum bulletin 69, 1903.

Plate 12

Gorge between the Middle and Lower falls. In the upper part of the Gardeau flags and shales

Plate 13



The Middle falls at Glen Iris. Gardeau flags and shales

South of the sandstone cliffs at Portageville the course of the Genesee river winds through a broad valley in which the only exposures of these soft beds are to be found in the various excavations in the adjacent hillsides.

The basal layers may be seen in the ravine ½ mile south of Bluestone; and at the falls of Wiscoy creek at Wiscoy the floor and walls of the ravine display 135 feet of the middle and upper beds. Near the top of the north walls above the falls the calcareous sandstones occur that succeed this formation and are the lowest of the "coarse sandstones with fossils of the Chemung group," referred to by Hall, in the Genesee river section. This band of sandstones comes down to the river level 5 miles south of Wiscoy and 1 mile south of Fillmore at Long Beards Riffs where it makes a low cascade and is exposed on both sides of the river. It was described and the designation "Long Beards Riffs sandstone" applied to it by Luther in New York State Museum bulletin 69, 1903. The lower beds of the Wiscoy division are mostly coarse blocky shales or soft sandstones with an occasional flagstone. In the middle and upper parts the sedimentation is generally finer, and there are several layers of black slaty shale one of which is 6 feet thick. An 8 foot bed of nodular shales lies next below this black bed and concretions from an inch to 3 feet in diameter occur throughout the entire formation.

Nearly all of the beds are calcareous to a greater or less degree and on the whole greatly resemble the Cashaqua shale. This resemblance becomes even stronger toward the west, but is lost to a certain extent toward the east owing to the increase of arenaceous matter.

The exposure at Wiscoy and in the ravines on the east side of the valley 1 to 3 miles farther south afford the best opportunities for examination of the Wiscoy beds. They are also exposed along Stony creek 2 miles west of Warsaw and slightly along the upper reaches of Relyea creek and Oatka creek, also east of the Genesee valley for ¼ mile north of Hunts along the Nunda road, and by the roadside 1 mile southwest of Dalton. Small outcrops are common by the roadsides and in the ravines on the slopes of the hilly region east of Nunda.

In Steuben county where these beds are coarser they contain many Chemung brachiopods and it is probable that the same species occur in this horizon in the eastern part of the Nunda quadrangle,

though owing to a lack of favorable exposure they have not been observed.

The fauna of the Wiscoy is a sparse one in both species and individuals.

The following have been collected from Wiscoy creek ravine and the gullies on the east side of the valley 2 to 4 miles farther south:

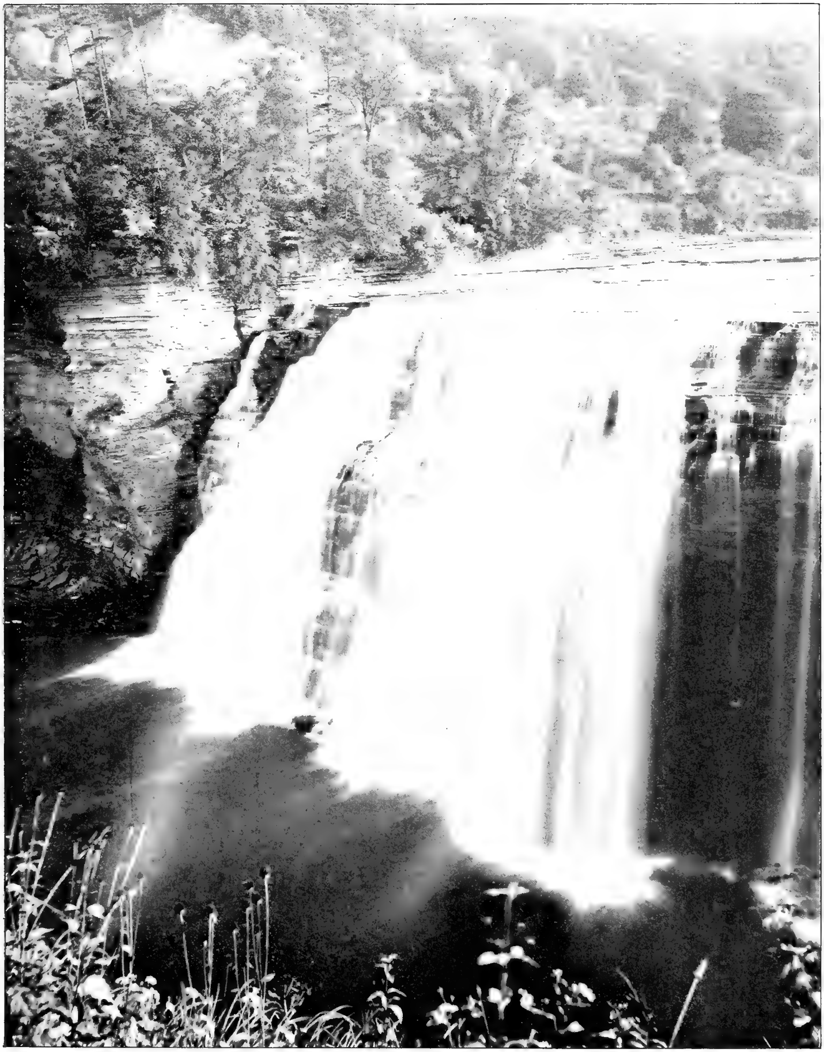
Manticoceras oxy *Clarke*
M. rhynchostoma *Clarke*
Orthoceras *sp.*
Pleurotomaria *sp.*
Hyolithus neapolis *Clarke*
Buchiola retrostriata (*v. Buch*)
Lunulicardium (Pinnopsis) wiscoyense *Clarke*
Paracardium doris *Hall*
Zaphrentis *sp.*
Lingula ligea *Hall*

## Chemung group

In discussing this division in Museum bulletin 81, 1905, (Watkins and Elmira Quadrangles) the following commentary was made on the general value of the term:

The term Chemung has been applied with such a breadth of meaning in New York stratigraphy that faunally and stratigraphically it no longer meets the requirements of precise expression. The formation has been, in a general and vague way, regarded as that mass of arenaceous deposits lying above the Portage of western New York and the Ithaca of central New York, from which there is, as is now known, a transition lithologically so gradual as to make a separation a pure convention. In respect to fauna the "Chemung group" has been commonly regarded as well defined by the presence of a notable series of species specially brachiopods, lamellibranchs and dictyosponges, all of which have been in a way regarded as centered about the species Spirifer disjunctus and the horizon, as a whole, including a thickness of from 1000 to 1500 feet of strata, regarded as the horizon of Spirifer disjunctus. This conception, as we have heretofore explained, is misleading, vague and inaccurate. The horizon of Spirifer disjunctus follows close on the change from the Naples fauna in western New York at a high altitude above the base of the Portage formation. In central New York there is no such change but the gradation from the Ithaca fauna out of the Hamilton fauna upward into the association which carries species elsewhere concurrent with Sp. disjunctus is very easy and it is extremely difficult to draw a division plane anywhere except on the basis of refined distinctions into successive faunules. Spirifer disjunctus in this eastern region did not appear till this period of "Chemung" deposition was well nigh over. For a precise use of this term Chemung therefore we are thrown back on the

Plate 14



Middle falls at Glen Iris, from the west side. Gardeau flags and shales

Plate 15

The Middle falls and the gorge below. The Erie Railroad bridge above the Upper falls in the background. Letchworth park on the right. Gardeau flags and shales

original employment of the name and we here cite the explanation of the term as first used by Professor Hall, taken from the Third Report on the Fourth Geological District, 1839, pages 322-24:

"The tops of the hills and high grounds in the towns of Erin, Veteran and Catlin, display a group of rocks and fossils very distinct from those last described. The essential difference is the lithological characters of the sandstone of this group in the absence of argillaceous matter in most of the layers, these being nearly a pure silicious rock, harsh to the touch, and generally of a porous texture; while still a large proportion of the mass consists of compact shales and argillaceous sandstones of a softer texture than those below. The surface of the sandstone layers is rough, while those below are smooth and glossy, and being never rippled, prove that the rocks were deposited in a quiet sea."

In the previous chapter we have referred to an already recognized necessity of removing from the Chemung division of the Genesee valley a lower portion which Professor Hall himself anticipated might have to be excepted therefrom on stratigraphic grounds only. With the Wiscoy beds eliminated there remains thereabove in this section 400 feet of sandstones and shales, not differing greatly from the Portage beds in appearance nor lithologically, though the sandstones are usually light olive-gray in color and more micaceous.

Thin layers of impure limestone resulting from aggregations of brachiopods and other fossils occur occasionally in the sandy layers but are most common in the upper beds. The shales are in all variations and shades of color from light blue gray and olive to deep black. Rows of small calcareous concretions occur in some of the lighter shales, and larger, but less clearly defined masses of concretionary character are in a few of the heavier sandstones.

The stratum containing brachiopods at Long Beards Riffs and Wiscoy falls is in the lower part of a band of sandstones and shales exposed at Mill's Mills and along East Koy creek, a mile north of Lamont. Soft shales prevail in the succeeding 400 feet of strata though there are several lentils of sandstone embraced in this part of the section. Exposures of this horizon in the vicinity of Pike, show mostly light shales that become rusty on exposure between thin rough flags 1 to 3 feet apart. In the Dingman quarry 1 mile north of Pike a 12 foot band of sandstones is exposed that is about 200 feet higher in the strata than the Long Beards Riffs lentil. These sandstones are also exposed along the Allegany road a mile southwest of Pike, where one of the layers contains a calcareous mass of fossils and after long exposure weathers dark brown.

There are many small exposures of this part of the Chemung group along the roadsides and in small gullies on these quadrangles, but none that show more than a fraction of the rock section. It is well displayed, however, along Caneadea creek and in other ravines on the next quadrangle south of the Portage.

At 1700′ A. T. on the Allegany road 4 miles southwest of Pike there is manifest a considerable change in the conditions of sedimentation, soft shales no longer predominating, but a series of flags and sandstones, many of which contain brachiopods in large numbers, appears and is exposed along the roadside showing a thickness of 150 feet or more, above which the rocks are covered by drift, but blocks of compact quartzitic gray sandstone, very coarse in structure and in some parts having the composition of a fine conglomerate, are scattered over the fields or built into the fences in such quantities as to make it evident that it is the bed rock in the vicinity of the crossing of the Allegany road and the east and west road near the south line of the quadrangle. There is no other favorable exposure of these sandstones on these quadrangles but they are amply displayed in the Belfast quadrangle.

Fossils are not abundant in the strata succeeding the Wiscoy shales for 400 feet except in a few thin seams in the lightest shales and in the heavier of the sandstones. The following species have been collected from the stratum succeeding the Wiscoy shale as Long Beards Riffs and Wiscoy:

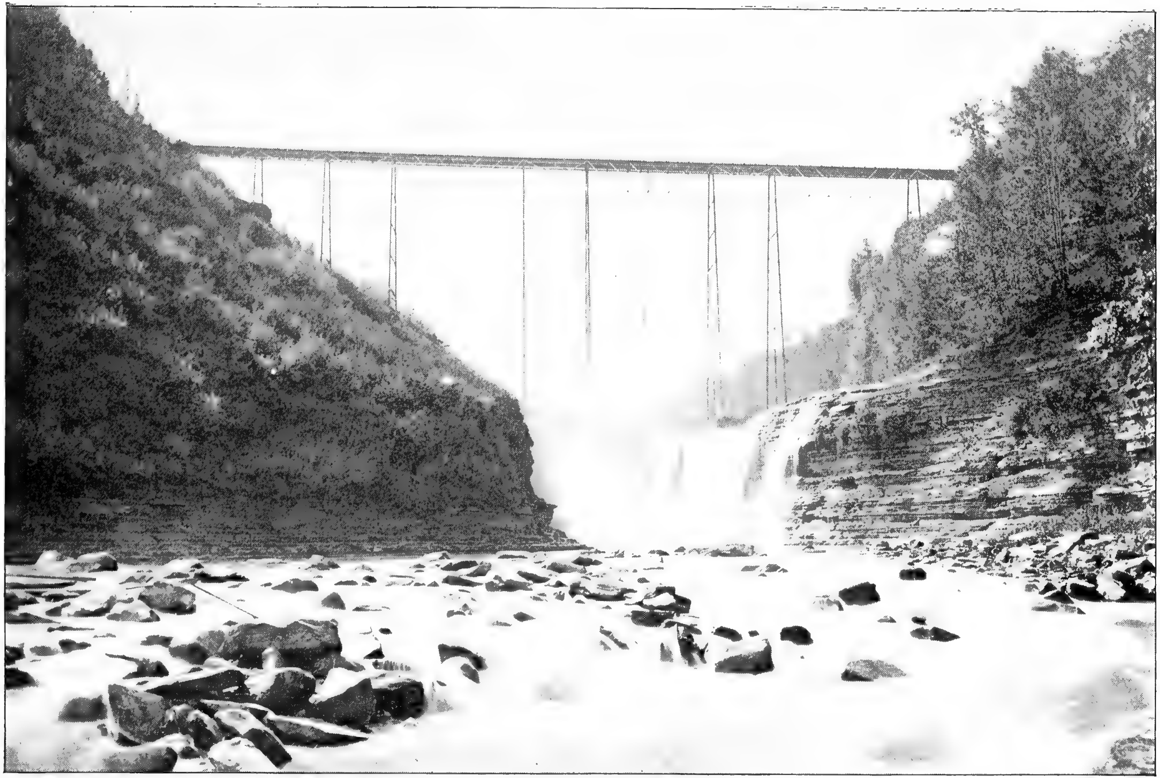
| | |
|---|---|
| Spirifer disjunctus *Sowerby* | Atrypa aspera *Hall* |
| S. mesacostalis *Hall* | Camarotoechia *sp.* |
| Liorhynchus multicosta *Hall* | Orbiculoidea alleghania *Hall* |
| Productella lachrymosa *Conrad* | Orbiculoidea *cf.* media *Hall* |
| P. speciosa *Hall* | Ambocoelia umbonata (*Conrad*) |
| P. hirsuta *Hall* | Lingula *cf.* melie |

and several unidentified species. These are the prevailing forms that appear in the lower Chemung beds on these quadrangles and most of them continue up into the heavy sandstones where they are much more abundant and where other species are added to the fauna.

## Dip

The rocks of these quadrangles show very little evidence of disturbance except in an even gentle dipping toward the south-southwest. The line of contact between the Moscow shales and Genesee slate has a westward declination of about 10 feet in the 55 miles

Plate 16



View of the Upper Falls and the Erie Railroad bridge. Upper Gardeau flags and shales

between its exposure at Moscow and on the shore of Lake Erie. This westward dip is increased by the thinning out of the Genesee and Portage beds, producing a different rate for each contact line. For the top of the Nunda sandstones the average is about 8 feet per mile with considerable variations due to slight undulations.

The average southern dip is 20 to 22 feet a mile and toward the south-southwest 30 feet a mile. This appears to be slightly increased in some of the quarries, possibly due to the relief from pressure following the excavation of the deep valleys on the sides of which they are located.

# PLEISTOCENE HISTORY OF THE GENESEE VALLEY IN THE PORTAGE DISTRICT

BY

HERMAN L. FAIRCHILD

## Evolution of western New York drainage

Any adequate discussion of the preglacial history of the Genesee river in its broader relations would involve the whole problem of the changes and adjustment in the drainage of the area of western and central New York and northern Pennsylvania during all time since the later Paleozoic. This is a large problem which has not been seriously attacked and one which requires much study. For the purpose of the present writing we shall be content with the briefest presentation of the elements of the problem.

It would seem certain that the primitive and consequent drainage of the western half of the State, along with the northern and western part of Pennsylvania, must have been southward or southwestward when the region was slowly uplifted from the seas as a coastal plain, bordering the old lands of Canada and the Adirondacks. Such elevation probably occurred not later than the Subcarboniferous. Many of our broader valleys, specially those with a southward or southwestward trend, are probably an inheritance from that earliest drainage across the uplifting plain. In the course of time the attitude, structure and composition of the rock strata, along with the up and down movements of the land, influenced the disposition of the drainage.

In the Ontario region a great thickness of weak rocks permitted the secondary or subsequent streams having east and west courses, along the strike of the strata, to develop and strengthen at the expense of some of the older and trunk streams. Eventually some of these subsequent streams united to make a great main or trunk stream, flowing either east or west, and so there was developed by atmospheric and stream work the great Ontario depression. With the deepening of the east and west Ontario valley the drainage along the southern side was reversed by streams developing northward flow toward the Ontarian river. In later geologic time probably

most or all of central New York was included in this reversed (obsequent) drainage, having northward flow down the inface of the Allegheny table-land. The valleys of the Finger lakes represent the work of such northward drainage,[1] but the most conspicuous and the longest example is the Genesee river.

During the long process of adjustment of the drainage there were great changes not only in land altitude but also in the climatic factors. Recently the Pleistocene ice sheets have plowed across the region and in a capricious manner have left some valley stretches filled with rock rubbish while other long stretches have been unfilled, or even scoured and cleared. Not only has the preglacial topography been thus obscured and the drainage diverted, but still greater interference with the old drainage was produced by the damming effect of the ice itself, in forcing the drainage into new lines, either southward or in directions along the ice front.[2]

The Genesee, as above noted, is the longest stream in New York which retains its preglacial northward course. It has persisted in its northerly course in spite of obstructions and diversions, for a little thought makes it evident that the damming and diverting effect of the glacier must have been to destroy the original northward flow rather than to produce such flow.

### Diversions of the river. Buried channels

In the course of the Genesee river there are three stretches where its valley shrinks to a narrow steepwalled ravine or canyon. One is at Portage, a second near Mount Morris, and a third at Rochester. The first two are parts of a single diversion of the river. Above Portageville and below Mount Morris the valley is broad and flaring and is evidently the result of weathering, storm wash and stream transportation during millions of years. The canyons represent the same kind of geologic processes as the open-valley stretches but only a small fraction of the time. Quantitatively the canyons are inharmonious with the rest of the valley, and have long been recognized as the very recent or postglacial work of the river where it has been forced from its old valley into a new path.

Logically it must follow that for each of the new stretches of the river course there must be a corresponding deserted stretch of the ancient valley. As to the cause of the changes in the river's course there is no disagreement among geologists, it being the interference

[1] See N. Y. State Mus. Bul. 45, p. 31-54; Geol. Soc. Am. Bul. 16: 55-56.

[2] For illustration of such glacial drainage *see* N. Y. State Mus. Bul. 106.

of the ice sheet, as described above. The deserted and more or less drift-buried stretches of the older valley must connect the existing open, mature stretches, passing around the new, ravine stretches.

The criteria for locating the abandoned stretches are as follows: (1) Direction: which would be expected to lie in fairly direct line connecting the open or unobstructed stretches. (2) Width: which should correspond to that of the old, open valley, making allowance for any difference in the character of the rocks. (3) Walls: which should have slope and height similar to the open stretches. (4) Depth: the original bottom of the deserted stretches must have been in accord or graded with that of the open parts. In want of deep borings sufficient to fully prove the location, depth and form of the buried stretches we have to rely at present on the general form and relation of the broader valley features and the exposures of rock. While these are not entirely satisfactory yet they are probably sufficient to show the main facts of the preglacial drainage.

**Rochester district.** Somewhere between Avon and Rochester the Genesee river leaves its old valley and enters its modern course, which becomes at Rochester a rock canyon with three cataracts, cut in Niagara, Clinton and Medina strata. The ancient and wider channel must have had a northward trend and somewhere must have crossed the Niagara scarp in order to join the river or lake which occupied the Ontario depression. From the St Davids valley to Sodus bay there is no break in the horizontal strata which could possibly have carried a large stream for a long time except the gap now occupied by Irondequoit bay (or lake). Here is an open valley over a mile wide, in hard rocks, and extending southward as a traceable depression some 15 miles. The depth of the Irondequoit valley to rock is unknown but the depth of water is given as 87 feet. The rock bottom of the old valley must be graded to the depth of the Ontario basin which runs into hundreds of feet a few miles out from the south shore.

The conclusion is unavoidable that here we have a portion of the old, preglacial Genesee valley, and the most northerly stretch now above the waters of Ontario. From the neighborhood of Fishers, in the Irondequoit valley, westward to the Genesee valley near West Rush, or to the mouth of the Honeoye creek, the old valley is so completely obscured that no confident suggestion of its course can be based on surface features. It appears most probable that the course of the river had been adjusted to the underlying rocks and

Nunda and part of Portage quadrangles

Nunda and part of Portage quadrangles

Preglacial drainage in Portage district: hypothetical

that a few miles north of Avon the channel bent eastward along the outcrop of the very soft Salina shale, similar to the present streams on the latitude parallel between Buffalo and Syracuse. This east and west stretch of the ancient valley, lying athwart the direction of the ice movement, was the part most filled by the glacial drift.

**Portage-Mount Morris district.** The canyons at Portage and Mount Morris together with the 8 miles of narrow intervening valley represent a single diversion of the river. Evidently the ravine-like valley from St Helena to Gibsonville is older than the canyons at the two ends, being V-shaped and flaring, although the rocks are as resistant as those of the Mount Morris canyon, locally called the "High Banks." Yet this valley is decidedly too narrow to have been a part of the Genesee valley, and is entirely out of harmony with the open valley above Portage and below Mount Morris. We must conclude that the St Helena valley belonged to some smaller or tributary stream.

The St Helena creek, as we may name the preglacial tributary, probably flowed south and entered the Genesee river 2 miles east of the Portage viaduct, near the Lewis corners [*see* map]. In a similar relation the depression followed by the Erie Railroad north to Silver Springs and including the valley of Silver lake probably drained south and joined the Genesee valley north of Portage by the break in the west wall at that point. This gap in the rock wall is too small to represent the old valley of the river, as suggested by Grabau,[1] but undoubtedly is the junction of a tributary valley. His suggestion that the old valley led northwest and comprised the Warsaw-Wyoming or Oatka creek valley can not be maintained. First, the break in the rock wall at Portage is insufficient to represent the river valley. Second, the gross topography indicates no sufficiently capacious valley leading toward Warsaw, and the obscuring drift is scanty. Third, while the Oatka has a handsome valley from Warsaw to Pavilion this has neither the size, form nor altitude that would represent the lower stretch of the river valley on that meridian, in soft shales. Fourth, rock appears at Castile in the bed of Wolf creek, at about 1260 feet altitude; and at the railroad station rock underlies the surface at near 1400 feet, thus effectually closing any river escape in that direction. Fifth, the head of the Warsaw valley, at Rock Glen, is in rock on both sides of the valley axis, at 1200 and 1300 feet. Sixth, the Oatka valley quite

[1] Bost. Soc. Nat. Hist. Proc. 1894. 26: 359-69.

disappears toward Leroy and the creek falls over the limestone in a mere notch. Seventh, the Onondaga limestone has a practically continuous outcrop from east of Batavia to the Genesee east of Caledonia, and no heavy stream ever crossed its scarp in that region in preglacial time.

In attempting to locate the ancient valley for the interval from Portage to Mount Morris we must apply the criteria as noted above and use the principles and argument as in the Rochester district. Assembling the topographic sheets it becomes apparent that only one valley is found on the map which meets the conditions. The valley of Nunda, now occupied by Keshequa[1] creek, and lying east of the present river, has fair direction, sufficient size and the proper depth where unfilled. The extensive moraine between Portage and Oakland is evidently the barrier between the Portageville and Nunda sections of the great valley. North and northeast of Portageville the walls of the valley are only drift and no rock is found anywhere in that district. On the steep slope south of Hunt (cut by the outflow of the fifth stage of the glacial waters as described below), in the creek gorge at Hunt's Hollow, and on the slope northeast, the rocks appear, but they mark only the eastern wall of the ancient valley. On the north no rock is found until the hill is reached north of Oakland. The old valley is very wide here and was probably broadened by the junction of four streams: (1) the Genesee, passing northeast; (2) the Silver lake-Castile affluent, from the northwest; (3) the St Helena tributary, from the north; and (4) the Dalton or upper Keshequa waters, from the southeast. This relation is indicated in the accompanying map.

Downstream, or northeast of Nunda, toward Tuscarora and Sonyea the higher and broader cross-section of the old valley is very satisfactory. From Nunda to Union Corners the eastern wall is plainly the slope of a great valley. The western wall is equally conspicuous though partially dissected by a shallow north and south valley northwest of Tuscarora. From Tuscarora to Sonyea the bottom section of the old valley is obscured by drift and is not so satisfactory. Rock appears at Sonyea station and half a mile east, on the 600 feet contour, and in the 2½ miles of the creek canyon south of Sonyea. Rock also appears north and south of Tuscarora, but probably leaves a channel a mile wide.[2]

[1] See footnote on page 53.

[2] Mr. Charles Haggardorn of Tuscarora, who has bored many wells in the Nunda district, informs the writer that borings at Nunda were in the drift to depth of 103, 97 and 73 feet. A mile east of Nunda Junction wells go to depths of 80 and 100 feet without reaching rock; and in Tuscarora the drift is not less than 100 feet deep.

The junction of the Genesee and Dansville valleys is not so clear and satisfactory as we might expect. The rock exposures restrict the valley width and the Genesee is made apparently a tributary to the Dansville river. But this seems to be the only possible outlet.

It is probable that the preglacial Genesee river with its full length had not been in its acquired channel a great period of time, or in other words was not a very ancient stream. The river had been produced by the diversion or capture or union of different minor streams, and had only in later time become adjusted to the course in which the glacier found it. The Dansville river was probably the older stream, though possibly smaller in volume. Before the ice sheet interfered with it the Dansville river probably collected the drainage from a large territory on the east of Dansville and south of the western members of the Finger lakes, including the upper Cohocton valley. Some of this drainage was inherited from the earliest time, and probably the valley had become mature while the Genesee was young. The glacial drift cuts off the former upper waters and sends them over southward by the Cohocton river, so that the Dansville stream is today only the Canaseraga creek. The greater maturity of the Dansville-Avon valley was noted by Dr Grabau.

It must be noted that the present floor of the Dansville-Avon valley is not the bottom of the old river valley, but only the top of the deep filling left by the glacier and the glacial lakes, with some contribution by the present streams.

### Glacial waters and canyon cutting

The initiation of the postglacial canyons and the history of their cutting is intimately tied in with the glacial lakes held in the valley. The various benches along the new channels of the river and the many terraces and plateaus of sand and gravel can not be understood without a knowledge of the lake history of the valley. And this drainage history of the Genesee valley is one of the most remarkable and dramatic stories in geologic literature.

During the long time, to be counted as many thousands of years, while the south edge of the ice sheet was slowly receding or backing away, from south to north, across New York State, the waters over the Genesee area were held up to high levels, being forced to overflow east or west. In the successive lowering of the waters by the opening of more northward outlets at least seven great river systems have received (and some of them more than once) the contribution of Genesee waters. In order of time these are as follows: (1) Pine creek-Susquehanna. (2) Allegheny-Ohio-

Mississippi. (3) Canisteo-Chemung-Susquehanna. (4) Glacial lakes Warren and Chicago to Mississippi. (5) Mohawk-Hudson (6) Gilbert gulf (sea level waters in Ontario basin). (7) St Lawrence.

In the present knowledge of the glacial and postglacial history of the Genesee drainage the writer recognizes at least 17 distinct stages or episodes. The first three stages involve only the upper (southern) part of the valley, the Portage district being then under the glacier. The Portage-Mount Morris region is involved in the history of stages 4 to 13. The subsequent stages concern only the valley north of Mount Morris. The history will be given very concisely in its relation to the district under present study.

**Stage 4. Belfast-Fillmore lake.**[1] Outlet was at Cuba, to the Allegheny-Ohio-Mississippi. Present altitude of outlet 1496 feet. Present altitude of the lake plain on the Portage parallel about 1530 feet.

During this stage the ice front receded as far as Portage, and lingering there deposited the Portage moraine which blocks the old valley in that district. South of Portage the valley was occupied by the lake which has left conspicuous evidences of its presence in the many water-leveled plains and terraces in the upper valley, with deltas at the mouths of side streams, having elevations of 1500 feet and upward.

**Stage 5. Portage-Nunda lake.** Outlet was by the Dalton-Swains rock gorge to the Canisteo-Chemung-Susquehanna. Altitude of the channel head, at Rosses, 1320 feet.

This stage endured while the ice front receded from Portage, Hunts and Dalton to Union Corners and Tuscarora, or through about 5 miles of meridional distance. However, the time involved was sufficient to allow the escaping waters to cut the steep rock bluffs south of Hunts and southeast of Dalton and the splendid rock gorge leading through Rosses and Swains to Canaseraga. As an example of an abandoned glacial river channel these features are unusually fine.

During this stage the Portage district was submerged in the lake waters which by their leveling action produced the level stretches and terraces of sand and gravel at and east of Portage with elevation from 1300 to 1325 feet. The plain at the Erie Railroad viaduct, 1325 feet, belongs in this category. The erosion plane of this lake extends up the valley to Belfast, and being lower and nearer the

[1] A fuller description of these early stages is printed in Geol. Soc. Am. Bul. 7:436-43.

middle of the valley they are the most conspicuous levels visible from the railroad between Portageville and Belfast.

**Stage 6. Dansville lake.** Outlet was at Burns past Arkport and Hornell to the Canisteo-Chemung-Susquehanna. Present altitude of the head of channel about 1210 feet. Present altitude of the lake plane at Portage about 1230 feet.

The first cutting by the waters as they fell below the fifth stage level is to be seen on the north point of the high ground in West Sparta and about one mile southeast of Union Corners. Here was the critical locality where the Portage lake waters first escaped between the receding ice wall on the north and the land slope on the south. The notching on the nose of the hill is evident, though not very conspicuous, at about 1300 feet and downward. When the waters came to a standstill as the Dansville lake, they produced the smoothing, leveling and shoreline work that is plainly seen at about 1200 feet around the nose of the hill.

This sixth stage lasted until the ice receded so as to uncover ground below 1210 feet in the vicinity of Linden and Attica, south of Batavia. As this new escape is on a meridian so far away from the Burns outlet no estimate of the duration of the waters can be made based on distance of the ice front retreat. Undoubted terraces of this level may be seen about Glen Iris at 1240 and higher; on the delta of Wolf creek at 1220 to 1240; and a plateau east of Bishop Corners and east of the river at 1230.

**Portageville morainal lake.** With the fall of the glacial waters below the Portage terraces, about 1320 feet, a local lake was left in the valley above Portage, being held up by the drift barrier. This water we have called the Portageville morainal lake. It was contemporaneous with the sixth stage of the glacial waters (lying northward), which from this time touch only the areas on the north.

It will now be seen that the gorge cutting at Portage began only with the overflow of the Portageville morainal lake, and that the glacial Dansville waters had no relation to the gorge except as possibly determining the base level for the stream and as the receiving body for the detritus. The initiation of the gorge cutting probably began at about 1320 feet, as it seems likely that the viaduct plain originally extended entirely across the valley. The top of the rock at the head of the canyon is at about 1240 to 1250 feet.

It will also be seen that the Portage river, draining the morainal lake, could not cut its channel lower than about 1230 feet during the life of the Dansville glacial waters, or only some 10 or 20 feet into

the rock. The stream detritus was dropped immediately northward in the Dansville water, to be largely picked up in later stages of the lowering waters and transported farther north.

The numerous lower terraces in the valley from Portageville up as far as Caneadea, and ranging from 1270 down to 1160, belong to the morainal lake.

**Stage 7. Mount Morris-Geneseo lake.** Outlets were by a series of channels on the meridian of Batavia and lying between Linden and East Bethany. The flow was west, across the Oatka and Tonawanda valleys to the great glacial lake Warren, with ultimate escape by Chicago to the Mississippi. The elevation of the outlet channels declines from 1200 to 1000 feet.

The former stages were comparatively steady levels of the waters, with only slow lowering as a permanent outlet was downcut. But this stage, and subsequent stages, comprise a series of falling water-levels as the receding ice front opened lower and lower passes on the north-facing slopes.

The several terraces north of the lower falls, with elevations of 1180, 1140 and 1090, may be correlated with these seventh stage waters. They represent remnants of the deltas built in the Mount Morris-Geneso lake by the river while it was cutting the Portage canyon.

**Stage 8. Lake Hall.** Outlets were between East Bethany and Batavia with elevations from 1000 down to 900 feet, the waters escaping to Lake Warren the same as in stage 7.

So far as direction of escape is concerned this stage is only a continuation of the stage 7, the outlet channels forming a continuous series [*see* N. Y. State Mus. Bul. 106, pl. 6]. It is made a separate stage because the Genesee glacial waters are now blended with the glacial waters of central New York. This stage is the successor in the central part of the State to the glacial lake Newberry, which had its outlet south by Horseheads and Elmira to the Susquehanna. This body of water is named after James Hall.

The water-leveled areas which correlate with this stage are the terraces east of Bishop Corners, at 940, 900 and 860 feet; and the extensive delta plain at Nunda, declining from 940 to 860 feet. Also the broad summit plateau at 900 feet at the top of the Mount Morris canyon, the "High Banks."

**Stage 9. Lake Vanuxem.** Outlets were at Syracuse to the Mohawk-Hudson, at elevation of 900 feet and declining.

While the ice was resting against the salient at Batavia it receded from the hills south and west of Syracuse permitting the impounded glacial waters to escape eastward, a direction of outflow contrary to the former stage. The waters are named for Lardner Vanuxem, whose district in the early Geological Survey of New York comprised the central portion of the State.

The higher terraces on the delta either side of the canyon at Mount Morris, at 840, 800 and 740, may have been made during this stage; also the deposits about the mouth of the Keshequa, and the lower terraces east of Bishop Corners, at 825 and 750.

**St Helena-Gibsonville morainal lake.** When the waters fell below 900 feet on the Mount Morris parallel the valley above the "High Banks" was left holding a local lake, which we name as given above. In preglacial time this valley probably opened to the south [*see* p. 73] as the walls at the north are rock. The lake may be called morainal, however, since the south end was blocked by the Portage moraine.

The St Helena-Gibsonville morainal lake (or St Helena lake for brevity) was contemporaneous with the Lake Vanuxem and later waters. The initial height of the lake is definitely shown by the broad gravel plain, coinciding with the top of the rock, at the "High Banks" at 900 feet; and the extensive delta plateau opposite the Silver lake outlet also at 900 feet. All terraces in the St Helena Valley below 900 feet must belong to the local lake and correlate with the downcutting of the Mount Morris canyon.

As the crest of the lower Portage falls is only 850 feet in altitude they could not have been initiated until the "High Banks" outlet and St. Helena lake was lowered to that level.

**Tuscarora morainal lake.** With the falling of the waters in the Dansville valley below 800 feet a local morainal lake was left in the lower or northern part of the Nunda valley, due to the drift blockade south of Sonyea. This local water did not reach as far as Nunda but covered the site of Tuscarora.

The point of lowest escape was north of the moraine, and north of the ancient valley. Falling on the rock the outlet was compelled to cut the shallow canyon, about 100 feet deep, southwest of Sonyea now occupied by the Keshequa creek and utilized by the railroad. During stages 9 to 12 the cutting must have proceeded, but with interruptions as the base level waters in the Dansville valley changed their level.

**Stage 10. Avon lake.** Outlets were at Honeoye Falls, Rush and Mendon, at 700 down to 580 feet, eastward to the Mohawk-Hudson.

Following the Vanuxem stage the ice at Syracuse receded so as to allow free river-flow through the site of that city and there was no extensive lake then held in central New York. But in the Genesee Valley the ice lay so far to the south that a local lake was held in the valley with its levels determined by the outlets noted above. The highest of these channels lies 2 miles west of Honeoye Falls and the lowest is the excellent abandoned channel followed by the Lehigh Valley Railroad through Rush to Mendon, at 580 feet. This Avon lake flooded the Dansville valley.

**Stage 11. Second Lake Vanuxem.** The relationship of phenomena in the Genesee and Batavia region theoretically requires a readvance of the ice at Syracuse and the restoration of the glacial Lake Vanuxem.[1]

It is not determined to what height the second Vanuxem rose, but it may have reached an altitude approaching 840 feet on the Mount Morris parallel. While this water lay over the Genesee region the ice backed away from the Batavia salient sufficient to allow Lake Warren to spread in from the west, and we have stage 12.

**Stage 12. Lake Warren.** Outlet was across the State of Michigan into the glacial lake Chicago and out to the Mississippi. Altitudes of the Warren beaches are generally about 880 feet in central New York, but on the Mount Morris parallel the plane is about 840 feet.

**Stage 13. Lake Dana.** Outlet was eastward toward the Mohawk-Hudson, at elevation about 700 feet, or about 660 feet on the Mount Morris parallel.

Lake Dana was only the longest of the pauses in the lowering of the Warren waters toward the Iroquois level. It is one phase of the Hyper-Iroquois waters.

The filling of the Genesee valley from Dansville to Scottsville with lake silts and smoothing them to the present form has been a process in activity since the sixth stage, and is now carried on by the present streams.

[1] The discussion of the glacial lake history of central New York and description of the drainage channels and lake phenomena will be found in a forthcoming bulletin of the State Museum.

### Later stages

Other stages now recognized are those of the Scottsville lake; Lake Iroquois; Gilbert gulf (sea level waters); and Lake Ontario. As water planes they lie inferior to the valley bottom at Mount Morris and therefore do not properly appear in this connection.

### Epitome of the history

Stage 4 Belfast-Fillmore lake. Outlet at Cuba; 1496 feet. Portage moraine formed.

Stage 5 Portage-Nunda lake. Outlet at Swains; 1320 feet. Erie viaduct terraces formed.

Stage 6 Dansville lake. Outlet at Burns; 1210 feet. Portageville morainal lake and beginning of the Portage canyon. Delta terraces at Glen Iris and mouth of Wolf creek.

Stage 7 Mount Morris-Geneseo lake. Outlets at Linden-Bethany; 1200–1000 feet. Delta terraces about the lower falls.

Stage 8 Lake Hall. Outlets at Batavia; 1000–900 feet. Terraces east of Bishop Corners; Nunda plain.

Stage 9 Lake Vanuxem. Outlets at Syracuse; 900 and declining. St Helena-Gibsonville morainal lake and beginning of the "High Banks" canyon. Tuscarora morainal lake and beginning of the Sonyea ravine. Upper terraces on Mount Morris delta.

Stage 10 Avon lake. Outlets at Honeoye Falls-Rush; 700–580 feet. Filling in Dansville-Avon valley.

Stage 11 Second Lake Vanuxem. Outlets at Syracuse; 700 feet and rising.

Stage 12 Lake Warren. Outlet via Chicago to Mississippi; about 840 feet on the Mount Morris parallel.

Stage 13 Lake Dana. Outlet toward the Mohawk-Hudson; about 660 feet on the Mount Morris parallel.

### Canyons and cataracts

The Portage canyon was cut by the outflow of the morainal lake held in the valley above Portageville, the earlier flow being into the glacial waters of stages 6–8, described above, and the later flow into the St Helena morainal lake.

The ravine and cataracts were not produced by free and uninterrupted flow of the river, with deepening of the whole ravine from

north to south, or upstream. The cutting of the canyon progressed downward from the top and from south to north. The upper cataract was established first and independently before the lower or deeper portion of the canyon had any existence. The down cutting of the canyon proceeded only as the receiving waters (stages 6–8) were lowered. The quantitative or progressive relationship of the two factors is uncertain, but it is quite possible that the glacial waters were so long-lived that the canyon cutting kept pace with or were even limited by the falling baselevel waters.

This relation of river and lakes explains the existence of three cataracts instead of only one, as would probably have been the case if the river could have fallen freely through the whole distance from Portageville to St Helena and the canyon cutting could have progressed normally and without vertical limitation. In rocks of variable hardness or resistance a stream might alone develop multiple cataracts, but the variation of the strata in the Portage section is not sufficient to cause three cataracts with the spacing that now exists.

When the Portageville morainal lake came into independent existence by the fall of the broader glacial waters below the level of the Erie Railroad viaduct plain, stream outflow began, probably at about the position of the railroad viaduct. The fall of the stream, however, was limited by the level of the receiving waters, and during the long life of the Dansville and Mount Morris-Geneseo lakes (stages 6 and 7) the river work was restricted to the higher part of the canyon. The lower part of the canyon, including the middle and lower contracts, did not then exist, being covered and protected by the lake waters. The upper and south cataract was independently initiated and established, and probably receded some distance, before the lower and northern part of the gorge had any existence. Eventually the falling of the glacial waters through the stages 6 and 7 brought the river into play in the horizon of the middle cataract.

As the crest of the third and youngest cataract is only about 850 feet elevation it is below the top of the High Banks canyon at Mount Morris, and it is therefore evident that the lowest part of the Portage canyon and the lowest cataract came into existence only as the High Banks was cut.

On account of the changes which have been produced subsequent to the initiation of the cataracts and the withdrawl of the glacial

waters it is not possible to correlate with precision the production of the cataracts and the limiting lake waters. The upper cataract correlates with the Mount Morris-Geneseo lake, though the beginning of the canyon was during the life of the Dansville lake. The middle cataract, with a crest altitude of 1005 feet, seems to belong with the Lake Hall stage. The lower cataract correlates with Lake Vanuxem and later stages. The initiation of the Portage canyon was an interrupted process, covering a varied lake history and a long period of time.

The Mount Morris or High Banks canyon is in shales of such weakness and uniformity that probably no large cataract was ever produced. The river rapidly removed all obstructions to its flow and acquired a uniform or graded slope. The initiation of the gorge was probably during the closing phase of Lake Hall, and the gorge may have been entirely cut during the life of the first Lake Vanuxem and the Avon lake. The gorge was cut from the top downward, and probably the erosion kept pace with the fall of the waters in the Dansville valley. If the strata were as hard as the Portage rocks probably cataracts would occur here also.

The history of the Rochester canyon is similar to that of the Portage. The upper cataract was established during the life of Lake Iroquois, the plane of which was nearly 200 feet above that of Lake Ontario. With the falling away of the Iroquois waters the lower and northern part of the gorge, with the middle and lower cataracts, came into existence.

### Deformation of the lake planes

In making close correlation of the lake phenomena and drainage it is necessary to take into the account the warping or tilting of the land which has occurred since the glacial time, and the consequent rise to northward which has been given to all the planes of the ancient lakes. The amount of deformation of the Portage-Mount Morris district is not known with precision but probably it is not far from 2 feet per mile.

The difference in the height of the correlating features according to latitude has not been regarded in the above description, except in a few cases. The figures used in the description are the altitudes which the features have as they stand today. In order to find the correlating planes for localities of different latitude 2 feet per mile should be added for northing or substracting for southing.[1]

[1] Some discussion of the matter of deformation of the lake planes is given in N. Y State Mus. Bul. 106, p. 76–79.

For close correlation of the lake-level features some allowance should be made for the depth of water in the outlet channel, and for the down cutting of the outlet during the life of the lake.

### Detrital filling of the valleys

All the ancient valleys have been so filled with glacial drift and lake sediments that in the absence of borings the grade slopes of the streams can not be determined. The localities of diverted drainage have been blocked by morainal drift, while the more open stretches of the valleys are more or less filled with stream detritus and lake silts, which may overlie glacial deposits.

The old valley above Portage has been considerably filled with glacial rubbish and later by lake sediments during the lacustrine stages 4 and 5.

The St Helena valley was largely filled with delta stuff during the stages 6 to 8, and during the life of the St Helena-Gibsonville morainal lake. With the cutting down of the "High Banks" it has been reexcavated. Any flooding during the stages 11 to 13 that overtopped the outlet stream must have produced deposition with subsequent reexcavation.

The Nunda valley was subject to lake deposition during the stages 6 to 9, and stages 11 and 12.

The old and broad valley from Dansville to Avon has evidently been subject to lake filling during all the stages from 6 to 13, and stream aggradation is still active.

# INDEX

## Appendix 3

# Entomology 27, 28

*Museum bulletins* 109, 110

27 Tussock Moth and Elm Leaf Beetle
28 22d Report of the State Entomologist 1906

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BULLETIN 397 MARCH 1907

# New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

**Bulletin 109**

**ENTOMOLOGY 27**

## WHITE MARKED TUSSOCK MOTH AND ELM LEAF BEETLE

BY

EPHRAIM PORTER FELT D. Sc.

*New York State Education Department*

*Science Division, October* 31, 1906

*Hon. Andrew S. Draper LL. D.*

*Commissioner of Education*

MY DEAR SIR: I communicate herewith for publication as a bulletin of the State Museum a paper of immediate importance by the State Entomologist, entitled the *White Marked Tussock Moth and Elm Leaf Beetle.*

Very respectfully yours

JOHN M. CLARKE

*Director*

*State of New York*

**Education Department**

COMMISSIONER'S ROOM

*Approved for publication, November* 3, 1906

A. S. Draper

*Commissioner of Education*

New York State Education Department

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JOHN M. CLARKE, Director

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ENTOMOLOGY 27

# WHITE MARKED TUSSOCK MOTH AND ELM LEAF BEETLE

BY

EPHRAIM PORTER FELT D. Sc.

These two insects must be ranked among the most important leaf feeders affecting the shade trees of cities and villages in New York State. They were responsible during the season of 1906 for widespread injury to thousands of trees, and the experience of earlier years shows that we must reckon with these species if we would preserve the beauty of our trees. Both of these pests, despite their destructiveness, are controlled with relative ease. The tussock moth can be readily suppressed in at least two ways, while the elm leaf beetle succumbs quickly to timely applications of arsenical poisons. Experience in the past has demonstrated beyond all question the practicability of checking both of these leaf feeders by spraying, an operation which is not very costly if modern apparatus be employed. We are forced to conclude therefore that extensive injury by either of these pests must be attributed to indifference or culpable neglect rather than inability, despite the fact that many appear very eager to take up the warfare at a time when the ravages are most apparent and unfortunately when repressive measures can be employed to very little advantage.

There is a tendency on the part of many private individuals to attribute their woes to the neglect of adjacent shade trees on public

streets, and conversely municipal authorities are prone to state that injury to public trees is due to the pests swarming thereto from neglected private grounds. The facts of the case are that both of these insects are very local in habit. This is a necessity in the case of the tussock moth, because the female is wingless and as a consequence the species relies for dissemination on the very limited crawling powers of the caterpillar or upon their being carried by other agencies. The elm leaf beetle, on the contrary, flies readily, but for some reason or other it is very local in its habits and not infrequently one may see magnificent trees infested with hordes of beetles and larvae, while within a block, sometimes within 50 feet, other elms may be practically free from the pest. These facts are of greatest importance to all interested in the welfare of shade trees, since they demonstrate beyond question the possibility of protecting the trees on our public streets, irrespective of what is done by private citizens, or conversely, the practicability of keeping the pest in check on private grounds, even though little or no repressive work is done upon those adjacent.

## White marked tussock moth

*Hemerocampa leucostigma* Abb. & Sm.

This insect, preeminently a pest on city and village trees, occasionally proves a veritable scourge over considerable areas. Some cities appear to be more afflicted in this way than others. Buffalo seems to have been specially unfortunate in the last six or seven years. The summer of 1906 was marked by extensive depredations in a number of cities and villages throughout the State, thus duplicating the experience of 1898. It will therefore be seen that serious injuries by this caterpillar are more or less periodic. This is to be explained by the fact that the species has a number of natural enemies which assist materially in keeping it in subjection. The destructive outbreaks are examples of what might occur annually were there no parasites to check the work of this voracious leaf feeder. The cause of this native species thriving so greatly in cities and villages during recent years is explained by the abundance of the English sparrow. This bird will not eat the caterpillars and drives away many of the native forms which, in earlier days, were of great service in devouring these hairy pests.

**Description.** The full grown caterpillar is really a beautiful object. It has a coral red head, a pair of long, black plumes just over it, a single one at the opposite extremity of the body, four delicate yellowish or white, brushlike tufts on its back and just behind them, separated only by a segment, two small retractile red elevations. There is a broad, black band broken only by tubercles and tufts along the back and bordered by yellowish stripes. Each side is dark gray except for the yellowish tubercles. The breathing tubes or spiracles are in a black line and below this the caterpillar is yellow, the legs usually being paler [pl. 1, fig. 4]. The very young caterpillar is pale yellowish or whitish with long, irregular hairs. It increases in size, casts its skin from time to time and assumes one after another the characteristics of the full grown larva.

The thin cocoons spun in the crevices of the bark [pl. 1, fig. 6] have the long hairs of the caterpillar interwoven and within this shelter the larva transforms to a yellowish white pupa more or less shaded with dark brown or black [pl. 1, fig. 7].

The sexes differ strikingly as is shown on plate 1, figures 1 and 2. The male is a beautiful moth with large feathery antennae, tufted legs, and with the wings and body delicately marked with several shades of gray or grayish white. The female, on the other hand, is a nearly uniform gray with simple antennae and but rudimentary wings.

The eggs, usually over 300, are deposited on the empty cocoon, under a conspicuous white mass of frothy matter about ½ inch in diameter [pl. 1, fig. 3]. This soon hardens and forms a very effective protection. The egg masses [pl. 4, 5] are easily removed and a tree thoroughly cleared thereof can become infested again only by caterpillars crawling from adjacent trees or being carried thereto. The individual egg is nearly spheric, about $1/25$ inch in diameter, white or yellowish white and with a light brown spot surrounded by a ring of the same color.

**Life history and habits.** This insect winters in the conspicuous egg masses described above, the young appearing about the latter part of May in this latitude. They feed at first on the more tender lower epidermis of the leaf and soon devour all but the principal veins. The caterpillars while young frequently hang by a silken thread and continued jarring may cause many to drop to the ground. Feeding and growth occupy a month or more, pupation occurring

the latter part of June or early in July. There is some deviation from this, as a few individuals spin up early and some caterpillars linger till numerous egg clusters indicate that most of the insects have completed the round of life. The pupal stage occupies from 10 to 15 days. The wingless female appears at the end of this period, crawls on her cocoon and shortly deposits eggs as described. There is normally but one annual generation in Albany and other inland cities, while in New York city and vicinity and in Boston, Mass. there are two broods and at Washington, D. C. there are three generations each year as stated by Dr Howard.

A peculiar habit, first recorded by the late Dr Lintner and subsequently observed by us, is the girdling of the elm twigs by larvae of this insect. This is caused by their eating a portion of the bark around the twig near the beginning of the season's growth [pl. 1, fig. 8]. The affected tips soon die, break off and fall in numbers to the ground. The young caterpillars drop from the tree readily, suspend themselves by silken threads and then may be blown or carried considerable distances. The full grown caterpillars desert the trees and wander considerably. This is particularly true of the larger ones which almost invariably produce female moths. The cocoons are spun very generally on the trunks or on the underside of the larger branches.

**Food plants.** This leaf feeder exhibits a marked preference in cities for the linden and horse-chestnut, while it feeds readily on elms and maples. It has also been recorded on a number of other trees.

**Natural enemies.** This species has a number of natural enemies. Its comparative rarity in the country shows that our native birds must be very efficient natural checks upon this insect. Mr E. H. Forbush states that 47 species of native birds feed on hairy caterpillars, most of which would probably take this leaf feeder. The robin, Baltimore oriole and cuckoo are among the more valuable in this respect.

Parasitic insects are also very efficient checks. This species is subject to attack by some 21 primary parasites and these in turn may become the prey of 14 hyperparasites.

**Remedies.** A simple and very satisfactory method of controlling this insect is the gathering and destroying of egg masses. Several cities and villages in New York State have employed children in this

work by offering a small bounty and a system of prizes. The result has been that a large number of egg masses were secured and destroyed at a comparatively slight cost. The defect in this method is that it is more or less irregular in operation and is usually resorted to only after serious injury to the trees has aroused public opinion. There is no doubt as to the effectiveness of collecting egg masses and in not a few instances it may prove the cheapest method of keeping this pest in cheek. It would seem better for the welfare of the trees to make some provision for the systematic collection of egg masses from year to year from all the trees, even though the cost be somewhat greater.

The collection of egg masses should be supplemented, if uncleaned trees are in the vicinity, by banding the trunks at the time the caterpillars begin to crawl, with some material which will prevent the ascent of straggling larvae. A very simple method is to take a band of cotton batting some 6 or 8 inches wide, wrap it around the tree, tie a string about its middle and then turn the upper edge down over the string. Tree tanglefoot, a preparation made by the same company that manufactures tanglefoot fly paper, has been used very extensively on trees about Boston. It is very adhesive, remains sticky for a considerable time and does not injure the bark of older trees at least.

The tussock moth caterpillar succumbs readily to arsenical poisons and where the trees are infested or are likely to be attacked by more than one leaf feeder, as is true in the Hudson valley, spraying is perhaps the best method of protecting the trees. One of the best poisons for this purpose, particularly in sections infested by the elm leaf beetle, is the prepared arsenate of lead, a compound specially manufactured for this purpose. It can be applied in almost any quantities without injuring the trees and is far more adhesive than the commonly employed london purple, paris green or other copper arsenites.

## Elm leaf beetle

*Galerucella luteola* Müll.

This destructive beetle, like the white marked tussock moth discussed previously, is a most dangerous enemy to certain shade trees, particularly in cities. It is in all probability responsible for more ruined elms in the Hudson valley than all other destructive agencies combined. It was so exceedingly abundant and injurious from 1896

to 1899 in the cities of Albany and Troy as to literally compel some action, or a very large proportion of the elms would have been destroyed. The insect obtained such a start in both of these cities that it was able to destroy or ruin about 1500 elms in each before the end of 1900. The vigorous measures employed both in Albany and Troy have mitigated the plague very largely and have demonstrated the practicability of keeping the insect in check. The results in both cities are evident to any observer, because instead of a large proportion of the elms having their leaves skeletonized and browned in midsummer, as was the rule in 1896 to 1898, the work of this pest is observed only here and there and is limited to sections where the trees have not been thoroughly sprayed or to localities where neglect is the rule. This was very well shown in the summer of 1906 in both Albany and Troy. The effective work of earlier years had led many to suppose that the elm leaf beetle was becoming less injurious and consequently there was a decided relaxation in the efforts to control this insect. A very large number of trees in both cities suffered severely as a result of this partial cessation in control work.

**Food plants.** This leaf feeder displays a marked preference for the more tender foliage of the English and Scotch elms, though after it has become abundant, it is frequently exceedingly destructive to the American elm. Its operations on this latter tree have been especially severe in the city of Watervliet.

**Distribution.** This pest has now attained an extensive distribution in this country, ranging from north of Salem, Mass. to Charlotte, N. C. and westward into Ohio and Kentucky. It occurs in most of the cities and villages in the Hudson valley, having made its way north to Glens Falls and along the Mohawk valley at least to Schenectady. It has become well established at Elmira and Ithaca, N. Y., and has been known for some years in Oswego, though it does not appear to have been particularly destructive in that city. There is no record known to us of this species occurring in Utica, Syracuse, Rochester or Buffalo, though it is rather surprising that it has not already become established in all of these cities.

**Description.** The skeletonized brown appearance of the foliage in midsummer is very characteristic of the work of this pest, particularly in the eastern cities and villages of the State. The irregular, oval holes about 1/4 inch in diameter, eaten by the beetles in early spring, are another indication of the work of this species.

The parent beetle may be recognized by reference to the colored illustration [pl. 2, fig. 5, 6]. It is about 1/4 inch long, with the head, thorax and margin of the wing covers a reddish yellow. The coal-black eyes and median spot of the same color on the head are prominent. The thorax is marked with a dorsal black spot of variable shape and with a pair of lateral ovoid ones. The median black line on the wing covers is widely separated from lateral stripes of the same color by greenish yellow. The wing covers are minutely and irregularly punctured, bear a fine pubescence and at the base of each there is an elongated, black spot in the middle of the greenish yellow stripe. These markings are fairly constant in the beetle, though the color is quite variable during life and changes more or less after death. Many of the insects emerging from winter quarters have the yellowish stripes of the wing covers nearly obliterated by black.

The orange-yellow eggs [pl. 2, fig. 1] are usually deposited in irregular rows side by side, forming clusters of from 3 to 26 or more on the underside of the leaf. Each egg is somewhat fusiform, attached vertically by its larger end and with the free extremity tapering to a paler rounded point.

The recently hatched grub [pl. 2, fig. 2] is about 1/20 inch long with the head, thoracic shield, numerous tubercles, hairs and legs jet-black. The skin is dark yellow but the tubercles are so large and the hairs so prominent that the prevailing color of the grub at this stage is nearly black. An increase in size, following molts, is accompanied by the stiff hairs becoming less conspicuous and the yellow more prominent, till the grub becomes full grown [pl. 2, fig. 3]. It is then about 1/2 inch long, more flattened than in the earlier stages, with a broad, yellowish stripe down the middle of the back and with a narrower stripe of the same color on each side, these being separated by broad, dark bands thickly set with tubercles bearing short, dark colored hairs. The dorsal yellow stripe is broken on each side by a subdorsal row of black tubercles which decrease in size posteriorly. The lateral yellow stripe includes a row of prominent tubercles with dark tips bearing hairs of the same color. The under surface is yellowish.

The pupa [pl. 2, fig. 4] is a bright orange-yellow, about 1/5 inch long and with a very convex dorsal surface which bears transverse rows of stout, inconspicuous hairs.

**Life history.** The transformations of this insect are so rapid and so greatly influenced by local conditions that a man must know what to expect or he will accomplish very little in fighting the pest, because a substance effective against the beetles or grubs may not kill the pupae and, after the larvae have begun to descend, may be of no value. The beetles winter in attics, sheds, outhouses and other shelters. They emerge with the advent of warm weather and may then be found on the walks during the sunny portion of the day or at the windows of houses, trying to escape. The last of April or early in May, with the appearance of the foliage, the beetles fly to the elms and eat irregular holes in the leaves. Some time is occupied in feeding before the deposition of eggs, a process which may continue four and possibly five or six weeks. The prolific beetles consume a large amount of foliage during this time, depositing clusters of from 3 to 26 or more eggs every day or two. Over half the total number of eggs may be laid at the hight of the season within about 12 days; in 1898, from June 12 to 23. A female may produce over 600 eggs.

The young grubs appear early in June or about five or six days after the eggs have been deposited later in the season. They feed on the under surface of the leaf, producing the familiar skeletonization [pl. 2, fig. 7] which is caused by their eating the softer underpart, leaving the veins and the upper epidermis practically untouched. The results of their feeding are so marked that it is easy to detect the presence of the grubs by the semitransparent patches in the foliage. These latter soon dry and turn brown.

There are two and occasionally three generations of this destructive insect in the latitude of Albany, the number depending to a considerable extent upon the availability of suitable food. The grubs complete their growth in from 15 to 20 days, descending limbs and trunk to a great extent in search of some shelter under which to pupate. Seven days are spent in this latter state in warm July weather, while in September it is extended to 12 and in October to 24 days. The grubs of the first brood usually forsake the trees in Albany by the last of June or early in July, and beetles belonging to the second generation may begin depositing eggs about the middle of July, and from then to late in autumn it is generally possible to find this insect in all stages in some part of Albany. The beetles of the second brood are naturally attracted to fresh foliage and conse-

quently more eggs are usually deposited on trees which have been defoliated earlier in the season than upon others.

Badly infested trees are therefore very likely to lose two crops of leaves in a season and may possibly have their third seriously marred by this pest. The second brood of grubs completes its growth about the middle of August, beetles appearing the latter part of the month, and if there is an abundant supply of fresh leaves, a third generation may appear in considerable numbers. This last brood more frequently occurs in near-by trees which have not been severely injured earlier in the season.

**Natural enemies.** This leaf feeder is subject to attack by a number of natural enemies, most of which, however, are of comparatively little importance in keeping it in check. The common garden toad will devour many beetles, and the much despised English sparrow also feeds upon these insects to some extent. Several predaceous insects prey upon this pest to a certain degree.

**Remedial measures.** The secret in controlling this insect lies in understanding thoroughly its life history and appreciating the vulnerable points. A thorough spraying with an arsenical poison early in the spring, when the beetles begin to feed, is most effective in preventing breeding, as the parent insects are destroyed before they can deposit many eggs. Fortunately the beetles are rather local in habit and as a consequence individual trees or groups of trees may be protected to a very large extent even if there are neglected ones in the near vicinity. The local spread of this pest is slow and this should be taken advantage of to the greatest possible extent by keeping the insect in control wherever it occurs, even though the infestation be a small one and the present injury of comparatively little importance. It is a mistake on the part of local authorities to wait till this enemy of the elms has become well established and destructive before repressive measures are undertaken.

The grubs feed almost exclusively on the under surface of the leaf, rarely occurring upon its upper side. The first injury is usually on the upper more tender leaves, hence there is great need of spraying the tops of the trees, and in order to kill the destructive grubs it is essential that the poison be thrown on the underside of the foliage. Spraying with an arsenical poison for the destruction of grubs is satisfactory only when the application is early, as it is hardly advisable to spray for this insect when the grubs are nearly full grown,

since they are liable to desert the tree even when slightly underfed and complete their transformations, rather than to eat distasteful foliage.

The full grown larvae crawl down the trunks in great numbers and the golden yellow pupae may be found in abundance in crevices in the bark and on the ground about the tree. A great proportion of the insects can be forced to take refuge on the ground by scraping off the rough bark, thus depriving them of shelters upon the tree. Large numbers can then be killed when assembled about the base of the tree by spraying them with a contact insecticide such as kerosene emulsion, whale oil soap solution or even by pouring boiling water on them. The grubs should be destroyed in the manner indicated every five days so long as the pests are seen in numbers, in order to secure the best results. This method of fighting the pest is advisable only when it is impossible to employ the more satisfactory arsenical sprays. Bands of tar, sticky fly paper, cotton batting etc., while they do no harm, can not be considered of much value in keeping the elm leaf beetle under control. The relatively few grubs caught on a sticky band are but a drop in the bucket compared with the masses which complete their transformations either above or below. It is worse than useless to attempt to control this or any other insect by boring a hole in the trunk of a tree and inserting therein compounds of any nature. The tree is weakened and unless the chemical be powerful enough to kill it, the insects are not affected.

# EXPLANATION OF PLATES

## PLATE I[1]

1 Executed from nature by L. H. Joutel.

## White marked tussock moth

*Hemerocampa leucostigma* Abb. & Sm.

1 Male moth at rest on trunk
2 Female laying eggs upon her cocoon
3 Egg masses on cocoons
4 A full grown caterpillar resting on a twig
5 Cast skins of caterpillars
6 Cocoons massed on trunk
7 Pupa of female within cocoon
8 Twigs girdled by caterpillars
8*a* Twig broken off at point of girdling
The foliage shows the effects of this caterpillar's work.


L. H. Joutel, 1906

James B. Lyon, State Printer

WHITE MARKED TUSSOCK MOTH

PLATE 21

1 Executed from nature, under the author's direction, by L. H. Joutel of New York city, and reproduced from the 5th Report of the Commissioners of Fisheries, Game and Forests through the courtesy of the commissioners.

## Elm leaf beetle

*Galerucella luteola* Müll.

1 Cluster of eggs, much enlarged

1*a* Side view of single egg, still more enlarged

2 Recently hatched larva or grub, much enlarged

3 Full grown larva or grub, much enlarged

4 Pupa, much enlarged

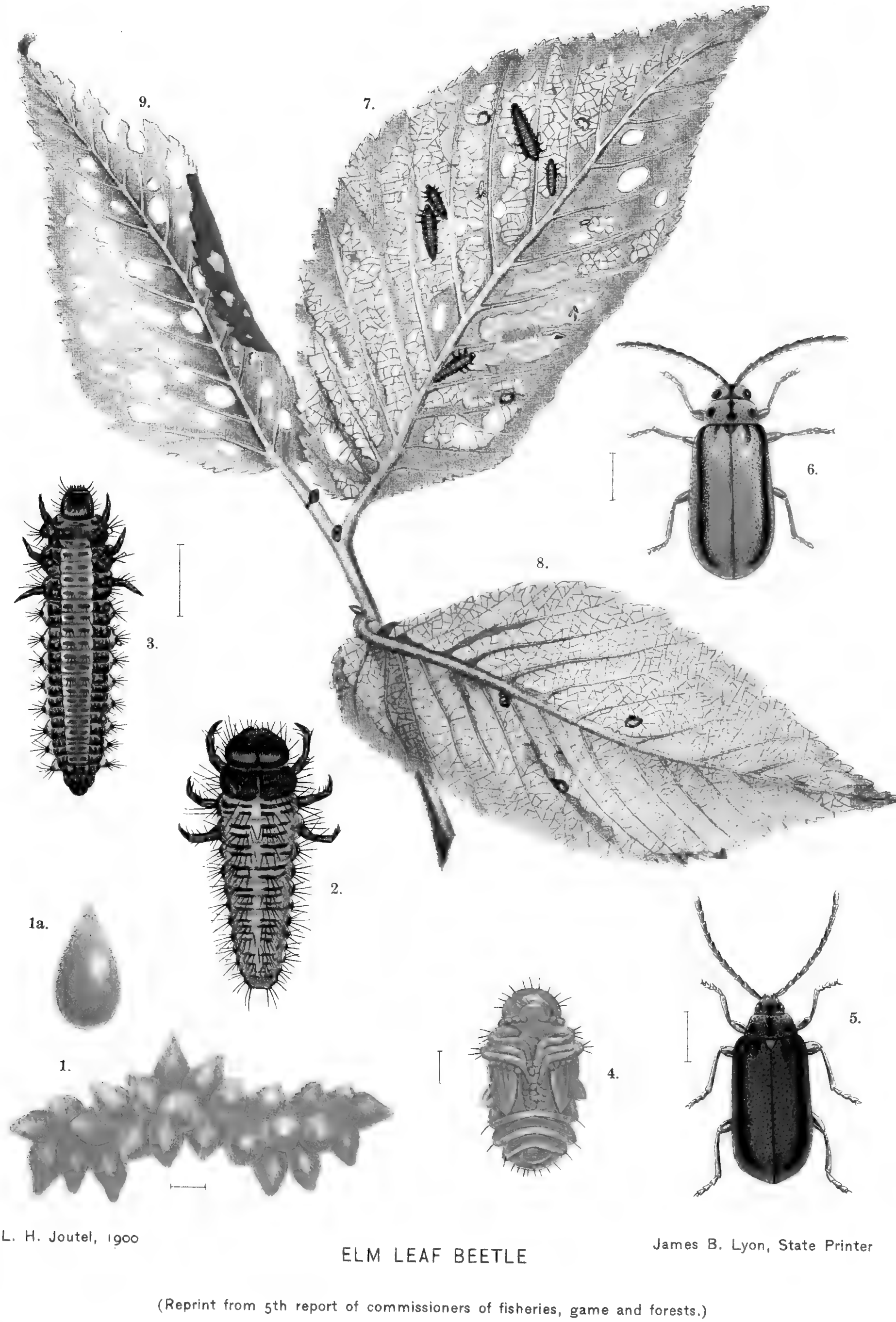
5 Overwintered beetle, much enlarged

6 Fresh, brightly colored beetle, much enlarged

7 Leaf showing eating of larvae or grubs and a few holes eaten by beetles, eggs in clusters, cast larval skins and full grown larvae, natural size

8 Leaf skeletonized by grubs

9 Leaf eaten by beetles




L. H. Joutel, 1900

ELM LEAF BEETLE

James B. Lyon, State Printer

(Reprint from 5th report of commissioners of fisheries, game and forests.)

PLATE 3

Work of white marked tussock moth, H e m e r o c a m p a l e u c o-s t i g m a Abb. & Sm., on clump of horse-chestnuts standing on the grounds of St Francis de Sales Asylum, Albany. Photo August 1906

Plate 3


Albany, Aug. 1906

Work of white marked tussock moth on horse-chestnut

PLATE 4

Egg masses of white marked tussock moth, *Hemerocampa leucostigma* Abb. & Sm., on American elm. Congress street, Albany, photo August 1906. Note that the egg masses are conspicuous, attached to slight cocoons and therefore easily removed.

Plate 4

Albany, Aug. 1906

White marked tussock moth eggs on Spring street

PLATE 5

23

Egg masses of white marked tussock moth, Hemerocampa leucostigma Abb. & Sm., on English elm. Capitol park, Albany, photo August 1906. Note that the egg masses are conspicuous, attached to slight cocoons and therefore easily removed.

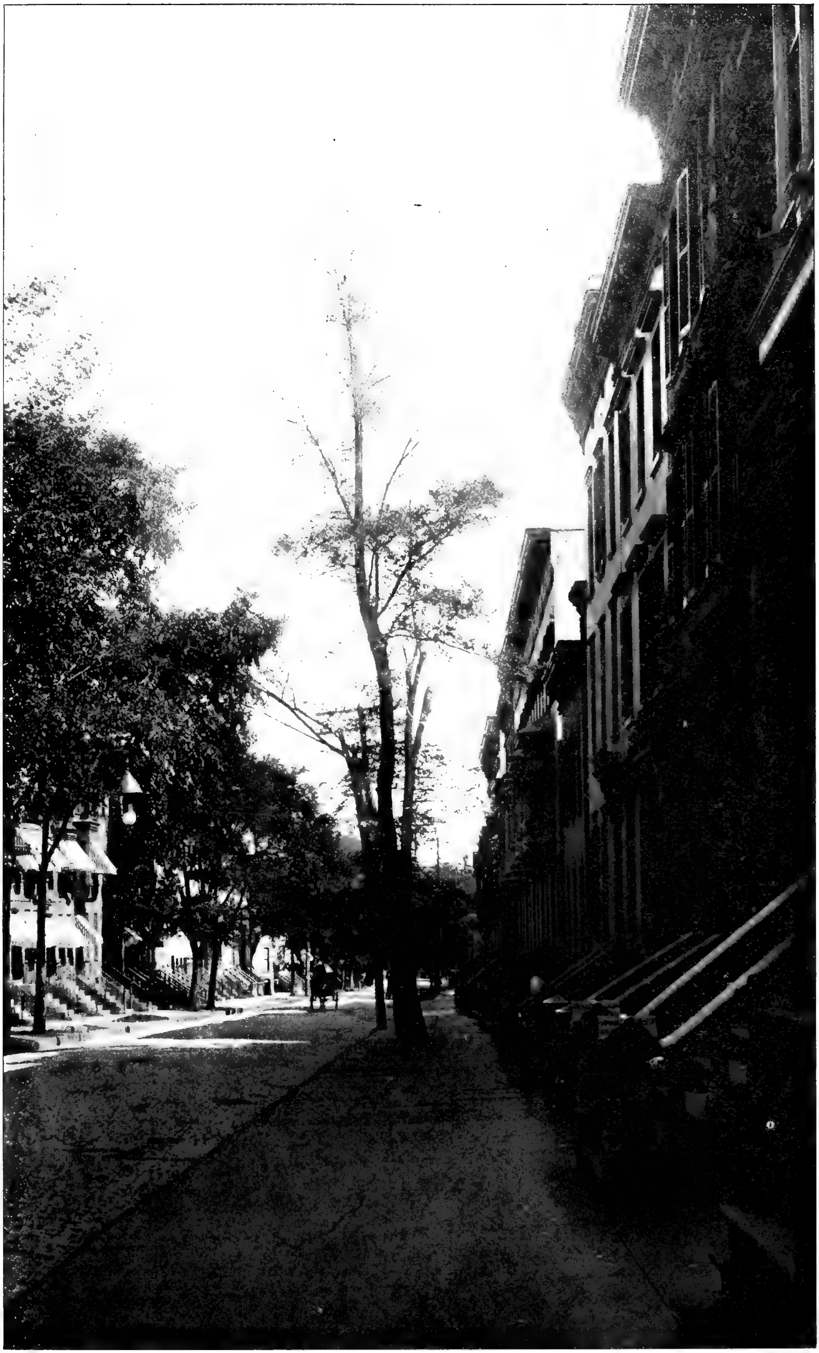
Plate 5

Capitol park, Albany, Aug. 1906

White marked tussock moth eggs

PLATE 6

A magnificent English elm nearly defoliated by the elm leaf beetle, Galerucella luteola Müll. Lancaster street, Albany, photo August 1906



Albany, Aug. 1906

Work of elm leaf beetle on Lancaster street

PLATE 7

Row of English elms on South Hawk street, Albany, nearly ruined by the work of the elm leaf beetle, Galerucella luteola Müll. Photo August 1906. These nine trees were, in 1898, in about the same condition as the one illustrated on plate 6.

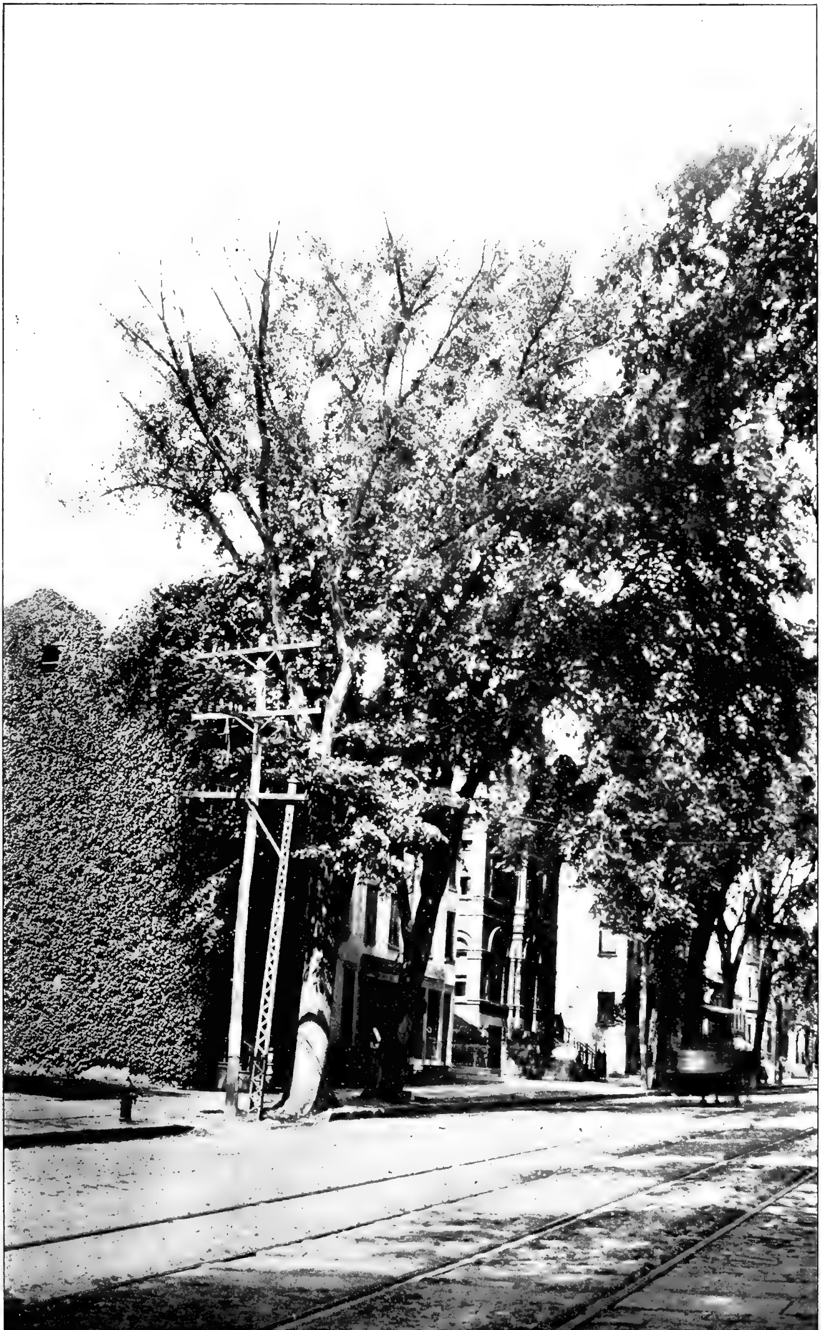
Albany, Aug. 1906

Work of elm leaf beetle on South Hawk street

PLATE 8

American elm on Washington avenue near Fort Orange Club, Albany, seriously injured by the elm leaf beetle, Galerucella luteola Müll., photo August 1906. Note the numerous dead limbs.

Plate 8



Albany, Aug. 1906

Work of elm leaf beetle on Washington avenue

# INDEX

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New York State Education Department

BULLETIN 403 JUNE 1907

# New York State Museum

JOHN M. CLARKE, Director

EPHRAIM PORTER FELT, State Entomologist

Bulletin 110

ENTOMOLOGY 28

# 22d Report of the State Entomologist

ON

# INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1906

*New York State Education Department*
*Science Division, December* 24, 1906

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

SIR: I have the honor to communicate herewith the report of the State Entomologist for the fiscal year ending September 30, 1906.

Very respectfully
JOHN M. CLARKE
*Director*

*State of New York*
**Education Department**
COMMISSIONER'S ROOM

*Approved for publication this 28th day of December* 1906

A. S. Draper
*Commissioner of Education*

New York State Education Department

# New York State Museum

John M. Clarke, Director
Ephraim Porter Felt, State Entomologist

Bulletin 110

ENTOMOLOGY 28

## 22d REPORT OF THE STATE ENTOMOLOGIST 1906

*To John M. Clarke, Director of Science Division*

I have the honor of presenting herewith my report on the injurious and other insects of the State of New York for the year ending October 15, 1906.

The season of 1906 has been marked by relatively few extensive depredations by insect pests. This is particularly true of the forms affecting garden, vegetable and other common farm crops. A remarkable large South American moth (Thysania zenobia Cramer) was taken in Albany the last of September. This magnificent moth has a wing spread of about 5 inches and its occurrence in this city is undoubtedly due to its having been brought north with a boat load of bananas or other tropical fruit. This capture is an example of the way in which insects are distributed through commercial agencies, though in the present instance it happens to be a species which can not sustain itself in this latitude.

**Fruit tree insects.** The San José scale is still regarded as a serious pest of the horticulturist, though the experience of recent years has demonstrated beyond question the practicability of keeping this insect in check by thorough and timely applications of a lime-sulfur wash. Our experiments conducted during a series of years show this insecticide to be fully as satisfactory as any other material which has been employed, despite the fact that a number of new preparations have been put on the market in recent years. These latter, though they possess certain very desirable qualities, have not been tested sufficiently so that they can be recommended without qualification.

We find the grape root worm still abundant in the Chautauqua region and the present indications are that some vineyards may be seriously injured by its depredations within a year or two. This

insect, as experience has shown, is more or less local in its operations and general predictions regarding its work are in most cases rather hazardous.

**Shade tree problem.** This phase of practical entomology has made considerable demands upon our time in the last few years. This has been due in large part to extensive defoliations of street and park trees in many cities and villages of the State by the white marked tussock moth, a species which rarely occurs in destructive numbers outside of municipalities and villages, and one easily controlled by intelligent effort. The elm leaf beetle has been particularly destructive in the Hudson valley and has become established in cities and villages in other portions of the State. The work of these leaf feeders and their allies has created a great demand for information along these lines. A number of popular articles have been sent to the local press in various parts of the State, urging the adoption of comprehensive measures for the protection of trees. It is gratifying to state that considerable interest has been aroused and most commendable efforts made to protect the trees. The city of Albany, in its budget for 1907, has made provision for the employment of a forester who will be charged with the general care of the trees. This plan, if carried out, provides for the protection of the trees from year to year — something which we have been advocating for some time. This is by far the most satisfactory way to care for street and park trees and we hope soon to see other cities and many villages adopting the same method. A special bulletin, treating of the elm leaf beetle and white marked tussock moth and giving summary accounts of each, has been prepared and will be issued shortly. More extended accounts of these and other insect enemies of shade trees are given in our recent publication on *Insects Affecting Park and Woodland Trees* [N. Y. State Mus. Mem. 8], a quarto work of two volumes comprising about 1000 pages, illustrated by 72 plates (20 colored) and over 200 text figures.

**Gipsy and brown tail moths.** These two dangerous insects, thoroughly and widely established in eastern New England, have been the objects of considerable attention at our hands. The gipsy moth in particular is a most dangerous leaf feeder and has excited much interest. Owing to the fact that this latter species has been very destructive in eastern Massachusetts and is still extending its range, it was deemed wise to distribute in many sections of the State a warning placard briefly describing the insect and the associated brown tail moth. This latter displays a marked preference

for fruit trees and is very annoying on account of the intense irritation produced by the urticating hairs of the caterpillar. The placard was supplemented by a bulletin [N. Y. State Mus. Bul. 103] giving more detailed information concerning these pests, with the result that many specimens of various insects were sent to the office for determination. The newspapers of the State cooperated most efficiently in disseminating information relating to these dangerous forms. It is gratifying to state that, so far as we have been able to discover, there is no ground for believing that either the gipsy moth or its destructive associate, the brown tail moth, has become established anywhere in New York State, though it would not be surprising were one or both of them to obtain a foothold in the near future. It is very important that our citizens should know about the gipsy moth in particular and be prepared to suppress the pest upon its first appearance.

**Aquatic insects.** The earlier investigations of this group have been continued. Dr James G. Needham has an extensive monograph on the stone flies (Plecoptera) nearly completed. This important work will prove an extremely valuable addition to our knowledge of a hitherto much neglected group. Dr Cornelius Betten, who has been giving special attention to the Caddis flies (Trichoptera) for the past five years, continued his studies last summer at Buffalo and Ogdensburg. These insects are an important element of fish food and, in addition, are of considerable local importance in the city of Buffalo. They breed in such large numbers in the rapids of the Niagara river that each summer the adults belonging to this group and the not distantly related May flies (Ephemeridae) swarm by the millions in portions of the city near the river front. The insects are so abundant as to prohibit outdoor painting during certain portions of the season. These flies were one of the factors which led to the locating of the Pan-American Exposition some distance from their breeding places. Dr Betten has given particular attention to this local phase of the problem and he is now engaged in preparing an exhaustive account of this very interesting and in some respects important group.

**Gall midges.** These minute, inconspicuous insects, belonging to a family comprising a large number of species have been subjects of careful and extensive investigations by the Entomologist and his assistants. Certain forms, like the Hessian fly and wheat midge, are of prime economic importance. The former is well known as an exceedingly destructive enemy of certain varieties of

wheat, and in 1901 caused an estimated loss in New York State alone of $3,000,000. The wheat midge in earlier years was also exceedingly destructive to this important grain crop. During the last decade another member of this family, the violet gall midge, has become a dangerous enemy of the extensive violet-growing industry, which has its most important center at Rhinebeck, N. Y. The members of this group are better known because of the many remarkable vegetable deformities they produce, and the adult insects present some extremely interesting morphologic variations. Continued and thorough collecting of these forms has resulted in the accumulation of a large amount of material. A recent catalogue lists less than 150 species as being native to North America, whereas our recent work has resulted in finding in New York State alone probably over 400 species, including therein representatives of genera hitherto unrecognized in this country, and presumably of others previously unknown. A clearer idea of the extent of our work may possibly be gained from the following: Mr J. R. Gillett, a medical student, was engaged during the entire summer in making some 2000 excellent microscopic preparations of these insects. These large additions to our collection will result in extremely important contributions to our knowledge of this hitherto relatively unknown group. The value of this work has been greatly increased by the enthusiastic and intelligent collecting of Assistant Entomologist Young and Assistant Nixon.

**Publications.** The Entomologist has contributed numerous economic articles to the agricultural and local press. The report of the office for 1904, owing to delays, did not appear till early in the fiscal year, and that for 1905 was not issued till September 1906. A special bulletin giving a summary account of the gipsy and brown tail moths [Mus. Bul. 103] was issued in midsummer and the first volume of *Insects Affecting Park and Woodland Trees* [N. Y. State Mus. Mem. 8] appeared in February. The proofreading and verification incident to the second volume going through the press has made large demands upon our time and it is a pleasure to state that this extensive work is now practically completed and will appear within a few weeks. Another important paper entitled *Diversities among New York Mosquitos* was reprinted from the *Year Book for 1904–1905* of the American Mosquito Extermination Society.

**Collections.** Some exceptionally valuable additions have been made to the State collections aside from those secured in prose-

cuting the special investigations mentioned above. A very fine collection of parasitic wasps (Chrysididae) was received from A. Mocsary, Budapest, Hungary, and a valuable addition to our Tachina flies from Dr Mario Bezzi of Italy. Some exceedingly desirable mosquitos from the south and southwestern part of this country, from Jamaica and the Philippine Islands were obtained through various correspondents of the office.

The special collections made by the members of the office staff in the Cecidomyiidae, mentioned above, have resulted in enormous additions to this group. The work upon the State collections has continued with unabated vigor and the general condition of the collections has been much improved, particularly in the families Ortalidae, Trypetidae, Dolichopodidae and Ephydridae. The representatives of the latter groups have been determined by Assistant Entomologist Young. The midges (Chironomidae) have received considerable study at the hands of Assistant I. L. Nixon, who has also devoted much time to the general arrangement and classification of the Coleoptera.

**Office work.** The general work of the office has been conducted about as in preceding years, the Assistant Entomologist taking charge of the correspondence during the absence of the Entomologist. The popular interest aroused in the search for the gipsy and brown tail moths in this State resulted in a great many insects being sent in for determination. This work devolved very largely upon Mr Young. A well sustained interest is shown by the correspondence: 2120 letters, 1284 postals, 215 circulars and 3317 packages were sent through the mails and 208 packages were shipped by express.

**Nursery certificates.** The practice of recent years has been continued and nursery certificates for persons desiring to ship into the state of Virginia indorsed by the State Entomologist upon the request of the State Commission of Agriculture. The following is a list of firms to whom these nursery certificates were issued during 1906: The Rogers Nurseries, Stark Bros., Bryant Bros., George A. Sweet, Morey & Son, G. W. Whitney & Co., Sheerins Wholesale Nursery, all of Dansville; Wheelock & Clark, T. S. Hubbard Co., George S. Joselyn, L. Roesch, Foster & Griffith, F. E. Schifferli, all of Fredonia; Reliance Nursery Co., The R. G. Chase Co., The M. H. Harman Co., all of Geneva; Jackson & Perkins Co., Newark; Stark Bros., Portland; Brown Bros. Co., Green Nursery Co., Charles V. Wyman, Ellwanger & Barry,

Western N. Y. Nursery Co., T. W. Brown & Son Nursery Co., Chase Bros. Co., Perry Nursery Co., The Bay Nursery, McGlemon & Kirby, The Hawk's Nursery Co., H. S. Taylor & Co., all of Rochester.

**Voluntary observers.** These correspondents of the office have continued to send reports throughout the growing season and a number of valuable facts were brought to our notice in this way. These records increase in value with the advance of years.

**General.** The office is indebted to Dr L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, and to members of his staff for kindly determining various insects submitted to them throughout the year.

In conclusion it may be stated that the enthusiastic cooperation of voluntary observers and others in touch with the office, the increased correspondence, and the great demand for our publications indicate a well sustained interest in this branch of scientific work.

Respectfully submitted

EPHRAIM PORTER FELT

*State Entomologist*

*Office of the State Entomologist, Albany, October* 15, 1906

## NOTES FOR THE YEAR

The following summarized accounts treat of some of the more interesting forms observed during the season. An unusual occurrence was the capture in Albany of a large South American moth (Thysania zenobia Cramer) which is represented in the natural size on plate 1. This species was undoubtedly brought to Albany with a boat load of tropical fruit. More common forms observed during the year have been grouped together under appropriate heads as in previous reports.

### Fruit insects

**Yellow-necked appletree caterpillar** (Datana ministra Drury). This common leaf feeder is more or less abundant in orchards from year to year, and during the past season, caterpillars were received the latter part of July and throughout August, from various sections of the State. The young of this insect feed in clusters and, as a consequence, their depredations are more apparent than those of the more solitary feeders. Injury can frequently be prevented by cutting infested tips bearing clusters of caterpillars and crushing the pests, or recourse may be had to treatment with arsenical poisons. The sprayings ordinarily given for the control of the codling moth and early spring leaf feeders, are usually amply sufficient to prevent this species from inflicting any material injury.

**Red-humped appletree caterpillar** (Schizura concinna Abb. & Sm.). This rather common leaf feeder is more or less prevalent in orchards of the State, and numerous specimens were sent from different sections from late July throughout August. It is very rarely that this insect is abundant enough to cause any appreciable damage, and ordinarily the sprayings given for the control of the codling moth and the earlier leaf-feeding insects are amply sufficient to keep this species in check.

**Gipsy and brown tail moths** (Porthetria dispar Linn., Euproctis chrysorrhoea Linn.). These two insects have aroused considerable apprehension in New York State in the last two or three years. This is particularly true of the gipsy moth, since the automobile has become so popular, because experience has shown this vehicle to be a most efficient agent in disseminating this destructive leaf feeder. This insect is steadily extending its range, having become well established in southern New Hampshire, made its way west in Massachusetts to Maynard,

Stowe and Marlboro, and a colony has been found at Stonington, Ct. The brown tail moth flies readily and has already become established in the Connecticut valley. There is no knowing when either of these insects may enter New York State, and owing to the importance of detecting their presence as soon as possible, it was deemed advisable to issue a warning placard, figuring in colors and giving the salient characteristics of each. It was distributed early in July. The placard was supplemented by Museum bulletin 103, which gives a summarized account of both insects and their work. The reader is referred to this publication for further details respecting these dangerous pests.

These two publications aroused much interest among all classes. The press cooperated in a most satisfactory manner, most of the local papers publishing extracts from either the placard or the bulletin, and some giving rather extended accounts culled from these publications. A large number of people were interested and many leaf-feeding caterpillars in particular were sent to the office for identification. Reports of serious injuries by supposed gipsy moth were published by various newspapers during the summer, but without exception it was found that the ravages were due to the work of some other pest and that it was therefore a case of mistaken identity. The efforts outlined above were supplemented by special inspection by Assistant I. L. Nixon, about the railroad yards of New York city and vicinity, Poughkeepsie, Albany, Rensselaer, Karner, Troy, Watervliet, Cohoes, Schenectady, Mechanicville and Rotterdam Junction without finding any signs of these insects. This examination showed beyond question that so far as most of these yards are concerned there was very little opportunity for the gipsy moth, carried either as eggs or caterpillars, becoming established, as there was not much available vegetation in the near vicinity of most of the tracks. It is a source of gratification to state that, so far as known at the present time, neither the gipsy moth nor its associate, the brown tail moth, has become established in New York State. There is still great danger of these pests becoming established within our boundaries, and we would therefore bespeak the further cooperation of all interested in the subjection of insect enemies, since a relatively small effort at the outset may prevent enormous losses later.

A personal inspection of the infested region in eastern Massachusetts during July showed that conditions generally were much better than they were the preceding season, or in fact at any time within the last two or three years. There has been a most hearty

cooperation between local authorities and State officials in Massachusetts, and as a consequence the numbers of both pests have been largely reduced, in spite of the fact that they were exceedingly abundant the preceding summer. Some extended woodland tracts were completely defoliated, and the control of the gipsy moth in such situations is still a grave problem. The federal government is cooperating with the state of Massachusetts in an effort to prevent the further spread of the insect as well as in studying its natural enemies. It is proposed to keep all trees near highways as free from these insects as possible, in order to prevent their being carried into new territory by users of the highways. This alone should reduce very largely the danger of the gipsy moth becoming established in other sections.

A serious effort has been made to secure natural enemies. Dr L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, has an extensive acquaintance with foreign entomologists, and this enabled him to secure the services of a number of skilled specialists for the collection and shipment to this country, of large numbers of parasites of both the gipsy and brown tail moths. Shipments were sent directly to Sup't A. H. Kirkland and installed in the parasitic laboratory at Saugus. The insects were carefully bred out, the dangerous secondary hyperparasites destroyed and the beneficial forms reared in cages, and those abundant established under favorable conditions in the open. The results obtained during the season of 1906 have been very successful, in that several important natural enemies have completed their life cycle in this country and it now only remains to ascertain whether they can stand the rigors of the New England winter and multiply sufficiently to be of material service in checking these two pests. The outlook for this line of work is certainly very encouraging, and so far as controlling these insects in woodlands is concerned, it appears to be the most practical way of attaining this much desired end.

**Oriental slug caterpillar** (Cnidocampa flavescens Walk.). This slug caterpillar was discovered in the vicinity of Boston at Dorchester, Mass. in 1906 and careful examination showed that it had become established over a territory about 2 miles long and 1½ miles in breadth. It appears to be a species that can sustain itself readily in this latitude, though, as our native slug caterpillars rarely become abundant enough to cause any material injury, it is hoped that the same may be the case with this

introduced form. This leaf feeder was probably brought into the country on Japanese nursery stock and Dr. H. T. Fernald, writing on the same, states that it has an extended distribution in the Orient, occurring in Japan, on the Island of Yezo and southward at least as far as Yokohama. It also occurs in China near Pekin, where it is very abundant, and it has been reported as far south as the Yiangtse-Kiang river, just north of the 30° of latitude. This distribution would indicate that the insect will probably be able to exist all over the United States except the peninsula of Florida, north of Mexico and in southern Canada. Its eastern food plants are Celtis, birch, elm and Japanese persimmon. It was found mostly in this country on Norway maples, pear, apple and cherry, though it also occurred on crab apple, willow, black birch, oak-leaved white birch, oak, American elm, Wahoo elm, blackberry, beech, poplar, mountain ash and buckthorn. This data is culled from a recently issued bulletin by Dr Fernald.[1]

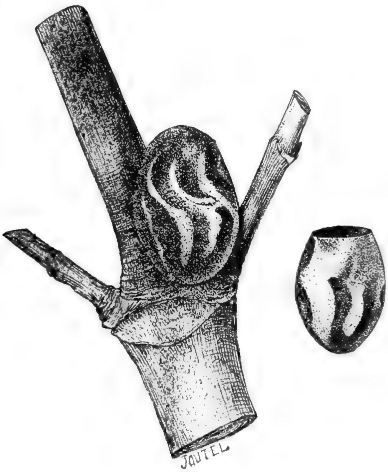


Fig. 1 Cocoons of oriental slug caterpillar; the larger probably female, on the twig; the smaller, probably male, empty, both enlarged (Original)

The cocoon is an oval structure with peculiar broad white stripes [fig. 1]. One specimen was found on a recent importation of Japanese maples in a greenhouse at Albany, though there is no evidence to show that the insect has become established in the open in this vicinity. It appears to be a common species in Japan. We have been informed of earlier importations of Japanese maples bearing similar, possibly identical, cocoons, so it would not be surprising were subsequent investigation to show that this slug caterpillar was already established in several widely separated localities.

**Scurfy scale** (Chionaspis furfura Fitch). This whitish, scurfy or chafflike scale continued abundant in the Hudson valley, being specially numerous in the vicinity of Annandale, where it caused considerable apprehension because many people mistook it for the San José scale, Aspidiotus perniciosus Comst., a species which has become well established in Germantown

[1] Hatch Exper. Sta. Mass. Agr. Col. Bul. 114. Jan. 1907.

and vicinity, only a few miles to the north. The scurfy scale, for some reason, has been abnormally abundant in this section, affecting mostly young fruit trees. Experience has repeatedly shown the practicability of controlling this pest by timely applications of contact insecticides, either whale oil soap or kerosene emulsion, the latter part of May or early in June at the time the minute, reddish young are crawling in large numbers.

**San Jose scale** (Aspidiotus perniciosus Comst.). This insect is one of prime importance to the small as well as the large fruit grower. The latter, if he is to continue in business and has infested orchards, must find some way of controlling the pest. The small fruit grower will soon find his fruit of very little value if this insect is allowed to breed unrestricted on the trees for a period of several years. The experiments and experience of the past decade have shown beyond all question the practicability of controlling this dangerous scale insect. The weight of evidence is decidedly in favor of employing a lime-sulfur wash which, if properly prepared and thoroughly applied, will give fully as satisfactory results as any other preparation. Recent experience has demonstrated the absolute necessity of great care in the making of this compound and thoroughly emphasized the value of most careful application.

Several experiments were conducted the past season, largely for the purpose of determining whether the lime-sulfur wash could be further modified to advantage. A lime-sulfur wash was made in the normal manner except that the ordinary burnt lime of this vicinity was replaced by a finely prepared hydrated magnesium lime known as limoid. The results were decidedly adverse to the employment of this material despite its improved physical condition. The reaction between the limoid and the sulfur was not nearly so vigorous, even when hot water was employed.

The following formula was used with very satisfactory results: 20 pounds of lime, 15 pounds of sulfur, 12 pounds of sal soda with 50 gallons of water. Half amounts were taken, the materials mixed together dry, and then two pails of hot water added. The reaction began in about two minutes and was quite vigorous though no cold water was necessary to keep the mixture within a half barrel. The compound was very satisfactory and there was very little sediment. This wash was applied April 13 to both moderately and very badly infested apple trees. An examination May 19 showed that this wash adhered fully as well as the others and

the same was true the 31st. A few living scale insects were found only after considerable search, whereas on the trees sprayed with the other washes there was not much difficulty in finding live scales. October 15 the trees treated with this preparation had some living insects on the more inaccessible portions. There appeared to be absolutely none on the accessible limbs which were more thoroughly sprayed than those on the other side. The general results were very satisfactory indeed.

Another formula, calling for 6½ pounds lime, 5 pounds sulfur and 2 pounds caustic soda with 16 gallons of water was prepared as follows: The dry materials were mixed together and then two pails of hot water added thereto. The reaction was very violent and the liquid was coloured a very dark red. There was little evidence of the greenish monosulphid. The combination was good though there was considerable sediment. It was applied April 13 to several plum trees which had badly infested limbs and on the 16th it was seen that the application had been very thorough. An examination May 31 resulted in finding a few living scale insects on these trees without much difficulty, and October 15 it was seen that there were very few living scales — in fact the treatment was very satisfactory. There was very little or no difference to be detected between these trees and those sprayed with the wash described above.

The third formula, calling for 20 pounds limoid, 15 pounds sulfur and 6 pounds caustic soda with 50 gallons water was used in one half the usual quantity. The dry materials were mixed together and the reaction started with two pails of hot water. It was prompt but very limited, owing to the fact that the limoid added very little to its vigor. The boiling seemed to be due almost entirely to the presence of the caustic soda. This preparation, after standing about two hours, was a light orange color with a somewhat greenish tint. It kept hot during this time. There was much sandy sediment and considerable undissolved sulfur or sulfur-lime. Perhaps 1 pound of the entire amount was in this condition. This wash was applied April 13 to apple trees with some limbs badly infested. May 9 this wash did not seem to have adhered as well as the others, and on the 31st it was not very difficult to find living scale insects. October 15 the trees sprayed with this mixture had distinctly more living scale insects than those treated with either of the above preparations in spite of the fact that the infestation was lighter than the others. There is no doubt

but that the limoid-soda combination destroyed many scale insects, though it was not as efficient as a wash where good quicklime was employed.

A general survey of Mr L. L. Morrell's orchard at Kinderhook showed that the same was in most excellent condition. This gentleman states that he has less scale on his trees than at any time in the past six years, and the excellent condition of his orchard sustains his statement. Mr Morrell is very well satisfied with the lime-sulfur wash though he is convinced that nothing but most thorough work, both in preparation and application, will give the desired results.

The control of this insect in old orchards is a problem that demands further attention. Mr W. H. Hart of Poughkeepsie, who has had this scale in an orchard of large trees for some years, has succeeded in keeping the pest well within bounds provided he was able to spray one side with the aid of a favorable breeze and then treat the other when the wind was in an opposite direction. This treatment was very satisfactory for the lower limbs and branches, but with the apparatus at hand it was found almost impracticable to successfully spray the higher limbs; consequently some of these were badly infested by the scale and eventually seriously injured. The tops of some of his large trees were mostly removed in the spring of 1905 before spraying was attempted, and during the summer they were in excellent condition. Certain other trees had the tops at this time in a very poor condition owing to injury by the scale and they were accordingly cut back in the spring of 1906 with equally beneficial results. It appears very probable that a large tree can be cut back to a greater extent than has been hitherto thought possible, provided some care is exercised. It may be that experience will show that this operation can be more safely performed after the upper portion of the tree has suffered somewhat from scale attack than if the attempt is made to cut it back while the tree is in unabated vigor.

Several oil preparations, popularly known as "soluble oils," have been put on the market in recent years, and some very sweeping claims made in regard to the same. One of the foremost of these, known as "scalicide," has been under observation during the season and a rather large orchard of young trees in the Hudson river valley was sprayed with this material. A few of the trees were rather badly infested by the scale, but most of them were comparatively free. An examination of the infested trees in October

showed that a few living scale insects occurred here and there. There was also some evidence of oil injury, though it is impossible at the present time to state whether this is great enough to be a permanent detriment. This can be determined only by subsequent observations and treatment. Another tree in the central part of the State, most thoroughly sprayed several times with this preparation, was entirely free from living scale insects though evidence of oil injury was a little more marked than in the first mentioned instance. These preparations are worth experimenting with though conclusions should be drawn with the greatest care. A few years ago we were told that crude petroleum could be applied in a diluted form without injury to trees and for a while this was accepted as true, but the work of later years has shown this to be erroneous, except possibly under unusually favorable circumstances. The so called " soluble oils " presumably differ not very much from those employed in earlier years, except that they have been brought into a very finely emulsified condition. There is danger that successive annual applications to trees may eventually result in serious injury, and a word of warning in regard to these preparations is therefore timely.

**Grapevine root worm** (Fidia viticida Walsh). This destructive enemy of the vineyardist continues abundant in the Chautauqua region and during the past season has been exceptionally numerous in certain vineyards. It is, as experience has shown in the past, such a local insect that one part of a vineyard may be very badly infested and another portion less than 100 yards away comparatively free from the pest. These conditions render it very difficult to make any general statements concerning this insect. There is no question but that it is becoming more abundant in certain vineyards here and there throughout the grape belt and its numbers have increased materially in the past year or two in some vineyards on the hills back from the lake. The insidious nature of this insect's operations renders it advisable that all growers should keep a close watch for the appearance of the pest in any numbers, and in case it becomes abundant they should adopt measures for its prompt suppression rather than allow it to multiply unrestricted and perhaps cause irreparable injury.

**Steely flea beetle** (Haltica chalybea Ill.). This pest, owing to the continued cold weather of early spring retarding the grape buds just after they had begun to open, had an exceptional opportunity to work and therefore caused more injury than usual.

This is due to the fact that its operations in the bud, destroying all the foliage and fruit which normally would come from that point, are particularly serious to the vineyardists since a very little feeding in this manner causes an enormous loss. This pest, as is well known, feeds upon the foliage in June as small brown grubs. Spraying at this time will destroy the young and largely reduce the numbers of beetles which can winter and attack the buds in early spring.

**White flower cricket** (Oecanthus niveus DeG.). The slender, whitish adults of this species are rather common during the latter part of the season and the oviposition scars made by the females are frequently met with in twigs and the stouter herbaceous plants. Occasionally this species is so abundant as to cause considerable injury, as was the case in the vicinity of Ripley, N. Y., during the fall of 1905, though the injury was not observed till early the following spring. Mr F. A. Morehouse of Ripley, under date of April 30, 1906, submitted specimens of the work of this insect and stated that some vineyards were very badly affected, many of the canes dying from the wounds inflicted. The investigation showed that the greatest injury was in vineyards where an abundant weedy growth was present. The most effective method of preventing trouble of this character is clean culture, since flower crickets display a marked preference for weedy places.

## Garden insects

**Twelve spotted asparagus beetle** (Crioceris duodecimpunctata Linn.). This species was observed last July breeding rather abundantly on a small plot of asparagus at Westfield, N. Y. in association with the common asparagus beetle C. asparagi Linn. It was not quite as abundant as the latter form though specimens were easily found on the vines and a number captured. This more recent introduction is already widely though locally distributed in New York State.

**Dark sided cutworm** (Paragrotis messoria Harr.). This rather common caterpillar was responsible for serious injury to primroses and other garden plants at Cold Spring Harbor, L. I. The attack occurred during the latter part of May. This cutworm, when full grown, is something over an inch long, dingy ash-gray in color, darker on the sides, with a dark, dingy dorsal line. Each segment is marked with eight small, black, hair-bearing tubercles arranged in two groups of four. The posterior extremity has a greenish tinge and the under surface and legs are somewhat lighter than the upper.

This cutworm and its allies are usually noticeable in early spring because of their depredations on young plants. Clean culture is one of the best methods of preventing injury and in the event of their occurring in numbers, poison baits, such as fresh clover dipped in paris green water or dry bran mixed with poison may be employed to destroy the pests. One of the most satisfactory methods, if the area is not too large, is digging out the cutworms and destroying them.

## Shade tree insects

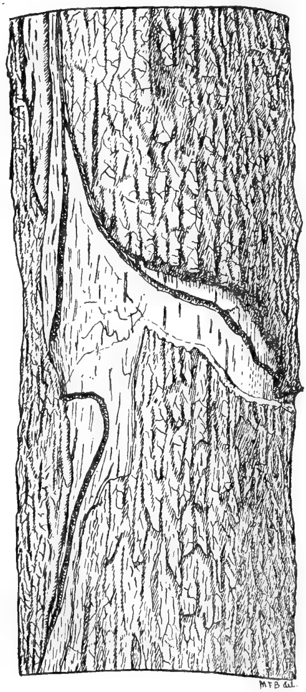


Fig. 2 Injury produced by a transverse burrow in a sugar maple about 18 inches in diameter (Author's illustration)

**Sugar maple borer** (Plagionotus speciosus Say). This destructive maple borer continues its operations in the beautiful shade trees ornamenting the village streets in the State. It appears to be particularly destructive in the central western part, and our attention has recently been called to severe injuries which were observed by us some seven years earlier. The maples in the village of Leroy, N. Y., appear to have been exceptionally unfortunate so far as attacks by this species are concerned. A considerable number of trees are infested by the borer and not a few have been severely injured. Earlier observations and work have shown the practicability of freeing infested maples very largely from this pest. Inhabited galleries should be carefully investigated and exposed until the borer is found and destroyed, either with a hooked wire or with a knife. Such wounds should be carefully dressed with a protective material, one of the best of which is a thick, pasty mixture of fresh air-slacked lime and cow dung. A covering of tar or a cheap paint is also very effective in protecting the exposed wood from fungus infection and further insect operations.

An exceptionally interesting observation on the work of this insect was made in connection with a recent trip to Leroy. Seven years before, namely, in September 1899, we photographed a tree in that village which had been badly injured by this insect and figure 2 represents the condition of the trunk at that time. The tree

is about 18 inches in diameter and at the time the photograph was taken was in rather thrifty condition despite the fact that one side was completely girdled by the operations of this borer. It will be seen, by reference to the illustration, that the dead area had already commenced to enlarge and it was, therefore, not surprising on examining the tree in November of this year to find that the area of the exposed wood had greatly increased. The gallery shown in the figure was approximately 4 feet from the ground. At the present time the entire affected side [pl. 2], from the ground to 8 or 10 feet above, is dead, the bark has decayed or fallen away, and a large proportion of the magnificent limbs and branches on that side of the tree has disappeared. This illustrates in a striking manner the destructive nature of this insect's operations. It is very probable that an injury of this character could be helped by bridge grafting, and it is presumable that extremely beneficial results would have been obtained even if this means had not been employed until two or three years after the initial injury, provided the bridge grafts were inserted in rather vigorous tissues. It certainly illustrates the necessity of closely watching our valuable maples and early adopting measures which will assist in their recovering from such injury.

We have shown elsewhere that the early work of this insect is readily detected by a careful examination in the fall, and the labor involved in cutting out and destroying the young grubs is very slight in comparison with the value of the trees. Systematic examinations by one familiar with the early operations of the borer should be most productive of good results and we commend the adoption of such methods to all villages possessing maples badly infested by this destructive insect.

**White marked tussock moth** (Hemerocampa leucostigma Abb. & Sm.). This leaf feeder, like the elm leaf beetle, is preeminently a city pest. The season of 1905 was marked by extensive injuries by this species in Buffalo, Lockport, Geneva, Rochester, Syracuse, Utica, Albany, Troy and Brooklyn. Some of these municipalities, as a result of popular agitation, adopted more or less effective measures for the control of this pest, and many egg masses were collected and destroyed during the early spring of 1906. Some sections of certain cities were largely freed from the pest as a result, while in other places the caterpillars were exceedingly abundant and destructive during the past season. This was particularly true in portions of New York and Brooklyn, Albany, Troy, Binghamton and Buffalo.

The caterpillars of this pest were so numerous on some streets and in parks of these cities as to be extremely obtrusive, occurring thickly on tree trunks, walks, fences and even the sides of buildings. Many of these places now harbor large numbers of the conspicuous white egg masses which, unless removed, give promise of a repetition of this plague in 1907. A summarized account of this insect has been prepared and will appear in a special bulletin treating of this species and the equally destructive elm leaf beetle.

A very interesting condition was observed in Capitol park July 5. Many of the trees were badly infested by the tussock moth, several being almost entirely defoliated, and that morning the ground was rather thickly strewn with leaves and leaf-bearing twigs. Most of the latter bore from three to five or six leaves, and the cut end had invariably been completely girdled for a distance ranging from one fourth to nearly an inch in length. This peculiar form of injury was first observed by the late Dr Lintner in 1883, who actually saw caterpillars engaged in the girdling operation. Subsequently questions arose as to whether the depredator was correctly identified. It is gratifying to state that the trees in Capitol park, mentioned above, were infested by practically no other insect, the tussock moth caterpillars were in several instances observed upon the falling twigs, and there is therefore every reason to believe that this larva was the author of this somewhat anomalous injury. The girdling was limited, as was also observed by Dr Lintner, to the new growth, and as the past summer has been exceptionally moist, it is barely possible that there is some connection between a rapid succulent growth and this form of injury, since it is only occasionally that the larvae girdle the twigs, as recorded above.

**Spiny elm caterpillar** (Euvanessa antiopa Linn.). This large, dark, red spotted, black spined larva is present in small numbers from year to year on elm, willow and poplar, in particular. Caterpillars were received from different sections of the State, from the latter part of July to the middle of August, and in most instances they were taken for the gipsy moth, Porthetria dispar Linn., an insect which has not become established in the State so far as known. This spiny caterpillar feeds in clusters and, as a consequence, its operations are much more apparent than if it were less gregarious. It is quite susceptible to arsenical poisons and easily controlled by these means wherever such treatment is advisable.

**Elm leaf beetle** (Galerucella luteola Müll.). This

destructive enemy of European elms, in particular, has been abnormally abundant in certain sections. It was reported as being quite destructive at Oyster Bay, Ossining, Fort Edward and Ithaca, while personal observations show that it inflicted serious injuries to many elms in Albany and Troy. Most of the damage in the latter places followed the relaxation of repressive measures, due to the erroneous idea that the insect was well under control and therefore capable of inflicting relatively little harm. Trees which received timely applications of arsenical poisons were practically exempt from injury, while others, which in some sections were in the large majority, lost a very high percentage of their foliage, some being nearly stripped. The experience of recent years has demonstrated the practicability of controlling this insect in cities and villages. A summarized detailed account of this insect has been prepared and will be issued in a forthcoming bulletin.

**Fall webworm** (Hyphantria textor Harr.). This well known species has been less abundant than usual as a rule, though larvae were received from different sections of the State from the latter part of August to the middle of September. The caterpillars, however, were in no instance excessively abundant. This species is easily controlled by removing the conspicuous nests and crushing the caterpillars within them, or by timely applications of an arsenical poison.

**False maple scale** (Phenacoccus acericola King). This species appears to be establishing a claim as one of the serious pests of the hard maple in New York State, since it has been quite injurious to trees in the vicinity of New York city, in particular, during the past four or five years. It was very abundant last summer at Port Chester, Middletown, and probably in other villages in the southern part of the State. It may be distinguished at once from the better known cottony maple scale by the fact that it occurs mostly on the foliage, the males making minute cottonlike cocoons on the trunk. These latter are frequently so close to each other as to give the infested tree an appearance of having been whitewashed. There are probably three generations of this destructive species in New York State. The young winter upon the trunk, beginning activities with the approach of warm weather, the second brood hatches in June and the third in August. The best method of controlling this species is in all probability by thorough spraying with a whale oil soap solution or a kerosene emulsion when the minute, yellowish young are crawling in abundance upon the leaves. This can be easily determined by a little observation. Whale oil

soap, used at the rate of 1 pound to 6 or 7 gallons of water, or the standard kerosene emulsion, diluted with nine parts of water, should be effective if thoroughly applied. A wash composed of 3 gallons of water, $\frac{1}{8}$ pound of hellebore and one teaspoonful of carbolic acid, applied to the infested portions of the tree with a whitewash brush in early spring, has been found very effectual in Illinois. It would not be surprising if a thorough application of a lime-sulfur wash in early spring would be equally valuable in checking this pest.

**Juniper scale** (Diaspis carueli Targ. Tozz.). This scale has been brought to notice several times on account of its occurring upon juniper in various localities in New York State. Mr John Dunbar, assistant superintendent of the park, Rochester, N. Y., writing under date of April 16, 1906, transmitted specimens of this scale and stated that it was becoming a menace to the juniper, Juniperus virginiana glauca, and also occurred on Pinus aristata, the latter being a new food plant for this species. Subsequent observations by Mr. Dunbar showed that this insect began breeding in Rochester early in June, and that thorough spraying at this time with a 5% solution of scalecide was very effectual in checking the pest. This scale insect was noticed in 1880 by Professor Comstock, who recorded it at that time as very common in Washington where it occurred on the following species of juniper and arbor-vitae: Juniperus chinensis, J. rigida, J. oxycedrus, J. japonica, J. communis, J. reresii, Biola orientalis and Thuya occidentalis. Messrs Riley and Howard recorded this species in 1895 from Jamaica Plain, Mass., where it occurred on Juniperus sphaerica, brought over from Germany some four or five years before.

**Elm bark louse** (Gossyparia spuria Mod.). This species has been quite destructive to elms, particularly the Scotch elm, in recent years. It is rather abundant and appears to be generally distributed throughout the city of Troy, N. Y. The females had attained their maximum development early in July and the woolly matter excreted from the lateral pores made the insects rather conspicuous. This bark louse while preferring European elms is also somewhat abundant on American elms, though hardly so injurious to the latter.

## Forest insects

**White pine weevil** (Pissodes strobi Peck). The blighting work of this weevil on pine is well known, though full

details regarding its life history are still wanting. These insects were rather abundant on hard pine at Nassau, N. Y. April 19, 1906, showing that the beetles appear very early in the spring. Some were feeding, a few pairing, and it is probable that breeding begins early in the season and is continuous to a greater or less extent until late in the fall, though there may be somewhat larger numbers appearing in early spring and possibly another brood in midsummer.

**Hickory tussock moth** (Halisidota caryae Harr.). The caterpillar of this moth is a very general feeder and specimens were received from the latter part of July to early in September, from localities in various parts of the State where the pest was devouring the foliage of a considerable variety of trees and shrubs. The depredations were in no instance exceptionally severe, and ordinarily repressive measures are not necessary. This leaf feeder is best controlled, when advisable, by timely applications of arsenical poisons.

**Black walnut worm** (Datana integerrima Gr. & Rob.). Specimens of this caterpillar were received during the last of July and throughout August, from different sections of the State. It is a more or less common species upon black walnut and butternut, occasionally becoming so abundant as to defoliate entire trees or groups of trees. It is possible to destroy many of the insects by cutting off infested branches while the caterpillars are still young and crushing them, or if the trees be of sufficient value, it is amenable to arsenical sprays. Unfortunately these applications are not, as a rule, practical in the case of large trees.

**Witch-hazel cone gall** (Hormaphis hamamelidis Fitch). The peculiar gall of this plant louse is ordinarily somewhat rare in the vicinity of Albany. The latter part of July and August it was seen that many of the witch-hazel clumps were badly infested with the galls of this species. They were so abundant on some shoots as to seriously injure and almost destroy the foliage. It was not at all difficult to find five to seven galls upon a single leaf and in some instances 20 to 25 could be counted.

## Miscellaneous

**Violet gall midge** (Contarinia violicola Coq.). This insect is undoubtedly a very serious pest of the extensive violet-growing industry in and about Rhinebeck. There must be close to $500,000 invested in this business and the gross annual income

therefrom is very probably an equal amount. A number of greenhouses were visited in October 1906, and several of them showed serious injury as a result of the work of this pest. The crop, according to estimates of growers, is reduced in many houses from one third to one half, involving a considerable loss in the aggregate, and should this infestation become more general, the results may be very serious to the industry as a whole.

An examination showed that the insect was distinctly local in its operations, since one half of a house 150 feet long might be seriously injured, while the other half was almost exempt from attack. Even in smaller houses there were distinct areas which suffered more severely than others, sometimes these being limited to only a square yard or two. The larvae at the time of our investigation had mostly disappeared, though in the Rockefeller house they were rather abundant. This is probably to be explained by the fact that the proprietors have allowed the temperature of their houses to remain rather high in the last few weeks, hoping to enable the plants in a measure to outgrow the injury earlier inflicted. The growers are almost unanimous in stating that when the temperature of a house can be kept down to 40 at night, not rising over 60 in the daytime, there is very little or no injury from this pest, and examination of other houses where this low temperature had been maintained, bore out their statements. The flies, according to the growers, very rarely leave the plants and can be discovered only by flushing them with the hand. An examination showed, even in houses where there were flies on the plants and numerous larvae, that none were to be found on the windows, even in the sheds at the ends of the houses nor in cobwebs spun here and there about the structure. The insect displays a marked preference for recently opened leaves, apparently depositing its eggs in those which have just expanded fully and, according to the growers, leaves perfectly straight one day may be badly curled the next. They note that leaves can be curled in a few hours and are of the opinion that only a day or so lapses between the deposit of the egg and the curling of the leaves, an operation which protects the larva from most insecticides. Furthermore, several of them state that fumigation with hydrocyanic acid gas apparently has no influence whatsoever in destroying the larvae, though there is little doubt but that the flies are killed. There is a marked periodicity in the abundance of the larvae. Last summer they were first noticed in numbers early in July and then they became abundant again in August, and experience this year has shown that they may continue working in

numbers even as late as the latter part of October. A number of infested leaves, portions of plants, were received October 10, through Mr Haines, from Rhinebeck. They were placed on soil the 12th and at that time no pupae were manifest. The first adults appeared on the 22d, others emerged subsequently to the 26th, when about four were bred out. Another individual was obtained November 3 and lived to the 5th at least. Owing to the fact that the plants could not be well cared for, it is probable that the period of the appearance of the flies was somewhat abridged by the unnatural conditions. The data above shows that not over 10 days are necessary from the time the larvae forsakes the plant till the appearance of the perfect fly and it may possibly be a little less. No pupae were observed on the leaves and there is no doubt but that the insect normally undergoes its final transformations in the soil.

**Remedies.** The parent fly appears to be closely limited to the plants about which it breeds and apparently very local in habit. This leads us to suggest that it would be advisable to take every precaution to avoid the introduction of the pest with newly set plants, since a little effort along this line would result in comparative immunity during most of the season.

Another important factor in checking this insect appears to be keeping the temperature as low as possible in the early fall. The injuries were much more marked, for example, in certain houses where there was an attempt made to hasten the growth of the plants by keeping them warmer than usual, than in other houses where there was no effort made to force the plants.

The experience of violet growers apparently indicates that fumigation with hydrocyanic acid gas is of comparatively little service in checking this pest. This is probably to be explained by the fact that they have been unable to give this treatment at a time when a majority of the flies were abroad and before a considerable proportion of the eggs had been deposited. It is presumably true that this powerful insecticide is of comparatively little value in killing the larvae, though it should be most effective in destroying the flies. Evidence at hand indicates a marked periodicity in the appearance of this insect and it is probable that a little observation would result in securing data which would enable a grower to fumigate at a period when most beneficial results could be obtained.

**Periodical cicada** (Tibicen septendecim Linn.). This insect, on account of its large size and its appearance in hosts at long intervals in different localities, is of great popular interest.

Six broods are known to occur in New York State, the one appearing the present season being designated by Dr Marlatt as brood 8. It is the one known as number 6 of Messrs Walsh and Riley, and was confused by Dr Fitch in 1855 with a 13 year brood, which occurs to the south. This species has been recorded from two counties in Massachusetts, it is listed from Long Island and occurs in several places in northern New Jersey and in central Pennsylvania. No detailed records, so far as we have been able to find, have been made of the occurrence of this brood in New York State, and this opportunity is taken to place on record certain facts concerning its distribution, which have been ascertained during the past summer.

This brood appears to be limited very largely to a section of Suffolk county west of Riverhead and occurring, so far as we know, in a very few localities in the eastern part of Queens county. The list of localities compiled from various correspondents is as follows: Wading River, Port Jefferson, Saint James, Farmingville, Coram, on the road from Port Jefferson to Patchogue, Manorville, Eastport, East Moriches, Center Moriches, Commack, Brentwood, Cold Spring Harbor, Laurelton, Huntington, Oyster Bay, East Norwich and Syosset. There is also a record of its presence in very limited numbers on Staten Island.

There is a bare possibility that this brood also exists in the Hudson river valley, though we are inclined to believe that the record given below is based upon a mistaken identity in the species or else that they may refer to stragglers from brood 12, due to appear next in 1911. Mr H. D. Lewis of Annandale, N. Y. who resides in one of the strongholds of this latter brood, states that this summer he observed several pupal cases, which he is quite confident are those of the periodical cicada, though we would not be surprised if he had mistaken therefor those of the harvest fly, Tibicen tibicen Linn., an insect which appears later in the season and at the time when the pupal cases were observed by Mr Lewis.

This species is such a unique form among insects that considerable interest has been aroused in regard to the possibility of its eventually being exterminated with the advance of civilization. The somewhat detailed records as to the abundance of this species in the various localities mentioned above, may prove of some service in determining this question in later years. The *Brooklyn Daily Times* of June 29 stated that periodical cicadas were present in large numbers at Wading River in the woodlands to the north of the Long Island Railroad experimental farm. The same paper,

under the same date, stated that a party of Wading River people, who drove from that place through Coram to Patchogue, reported that great numbers of this insect were crushed in the wheel ruts. The underbrush and low trees were literally covered with cicadas to such an extent that "it was like grasshopper days out in the prairies; the buzzing was deafening, one actually could not walk along the ground without stepping on them." The *Port Jefferson Echo* recorded the appearance of cicadas in the vicinity of that village. These insects were reported by the same paper as being very abundant at Saint James, and Mr George T. Lyman informed me that they were present at Farmingville in the middle of the island. Mr G. W. Raynor of Manorville, in the center of the island, stated that these insects were abundant in that vicinity. The *New York Tribune* of June 5 stated that cicadas were very abundant about Eastport, and that millions of them were filling the woods north of the village with their song. "The pests are said to be more numerous than at any time since 1864, and in some places they darken the air, hiding the sun. Persons driving along the woodland roads have their horses and carriages covered with clouds of the insects. In some localities they are so thick that men have had to stop work." The *Brooklyn Times* of June 6 stated that large numbers of the 17 year locust were seen in the woods north of East Moriches. The insect was also reported in large numbers from Center Moriches by Mr H. D. Smith. The *Brooklyn Times* of June 21 reports having received specimens of this brood from F. E. Nichols of Brentwood. There is a considerable area in the vicinity of Oyster Bay infested by this brood. The *Enterprise* of June 16 of East Moriches stated that these insects were drumming incessantly in East Pine Hollow woods and added that 34 years ago they appeared in the woods on the farm of Mr D. V. Horton and 17 years ago there were less of them than formerly. Through the enthusiastic cooperation of Mr F. E. Lutz, connected with the Station for Experimental Evolution at Cold Spring Harbor, we are enabled to present some detailed notes respecting the occurrence of this insect in that vicinity. There is a colony near Cold Spring Harbor at Laurelton, which does not extend west quite to Brookville. Another colony has its center near East Moriches, stragglers from this joining with the Laurelton infestation. About a mile south of Commack Mr Lutz found a pupal skin, and a few feet away, the battered remains of an adult. Careful searching failed to reveal others and none were heard.

A half mile farther south he found another cicada, and shortly thereafter got into the scrub oak region where the insects were very common. He did not consider them abundant, though collecting was easy and males could be heard in one direction or another nearly all the time. This colony extends to the improved part of the village of Brentwood. The colony at Cold Spring Harbor occurs on the Alton and Miami stony loam. It appears to have very definite boundaries, which do not coincide with anything in plants, soil or physiography so far as could be determined. Respecting the occurrence of this brood on Staten Island, Mr William T. Davis states that in April he received a pupa found under a stone by a friend. Later in the season, namely on June 10, he heard a periodical cicada call in a tree at Richmond valley; it did not sing long and consequently he was unable to capture it. Seventeen years ago a pupa skin of this brood was recorded from Staten Island.

This brood, as far as we can ascertain, does not occur on Long Island east of Eastport. There were no signs of its presence at Westhampton, and Mr F. A. Sirrine of Riverhead and J. W. Hand of Easthampton both reported no evidences of this insect in either locality. Furthermore, the cicada could hardly have been abundant on the eastern end of the island or some notice of its presence would have appeared in local papers.

It may be interesting, in this connection, to give some recent notes on brood 12, the largest occurring in New York State. It was exceedingly abundant at Annandale in 1896, and in examining an orchard October 9, 1906, several apple limbs were observed which showed plainly the scars made by this insect a decade ago. Many of them were nearly healed over, just an irregular crevice being the only external indication of the injury, while in a few instances the wound had been so severe that healing was not prompt, and as a result there is at the present time a considerable area of decayed wood with the oviposition scars in the center. The tissues growing around these wounded dead areas have enlarged the diameter of the branch considerably in one direction, and in not a few cases the limbs break off at these points of greatest injury. Mr H. D. Lewis, proprietor of the orchard states that the cicadas are so abundant in that section as to kill five year old trees and as a consequence he does not dare to set out young trees for some years previous to the time when a brood is due. He found during the previous appearance that rolling and harrowing the ground when the insects were emerging, resulted in destroying thousands.

He observed a decade ago a marked difference between localities cultivated as described above and other places where no attempt had been made to check the insects. So many were killed that he proposes to adopt this measure on the next appearance of this brood, in the hope of largely reducing the injury to his fruit trees. He is of the opinion that the adults are rather local, remaining as a rule near the place of emergence and rarely wandering away to a greater distance than $\frac{1}{2}$ mile.

*Preventive measures.* There is no very practical method of preventing injury by this insect, aside from refraining from setting trees a few years before a large brood is due in a locality. This caution is timely in respect to brood 12, due to appear in portions of Albany, Columbia, Dutchess, Greene, Orange, Putnam, Richmond, Rensselaer, Rockland, Saratoga, Ulster, Washington and Westchester counties and on Long Island in 1911. We would not advise the setting of young trees in localities badly infested by this brood, after the spring of 1907, and in certain situations where the insect is exceptionally abundant, it will be wise to refrain from setting out any more fruit trees till after the appearance of the brood.

Something may be accomplished, as detailed above, by timely cultivation and rolling, though it is obvious that these measures can be advised only where there is liability of considerable injury to fruit trees, or where conditions are such that comparatively little additional expense is involved, owing to the fact that there is need of cultivating the ground about the time the insects appear.

More valuable young trees and shrubbery can be protected from injuries by inclosing them with netting, preferably the ordinary mosquito netting, during the time the adults are abroad. This measure is obviously limited in its application to smaller trees and shrubs, and, as a rule, will be adopted only to protect the more valuable ornamentals.

## VOLUNTARY ENTOMOLOGICAL SERVICE OF NEW YORK STATE

Owing to a variety of causes the number of voluntary observers communicating with the office has been exceptionally small. This is due in part to relatively few important insect depredations, to a loss of interest on the part of some, and to the fact that other matters in the office prevented giving this branch of the work more attention than was absolutely necessary. It will be observed, how-

ever, that we have reports from typical localities in the Hudson river valley as well as the central and western portions of the State and that these accounts deal with the more destructive insect pests. There is decided advantage in having such correspondents in various parts of the State, even though they may not make exhaustive reports, since they are usually available should any emergency arise, and this is of considerable importance when the army worm or some other equally destructive insect is abundant.

**Cattaraugus county** [C. E. Eldredge, Leon] — The somewhat rare larva of the carpet fly (Scenopinus fenestralis Linn.) was observed in some numbers under carpets.—*May 2*. The silver fish (Thermobia furnorum Prov.) was found in woolen cloth which had been eaten by it or some other insect.—*July 11*

[F. A. Fitch, Randolph]— Cabbage butterflies (Pontia rapae Linn.) have appeared in small numbers. Tent caterpillars (Malacosoma americana Fabr.) are scarce.— *May 21* Horn flies (Haematobia serrata Rob.-Desv.) have become quite troublesome and cabbage worms are now abundant and injurious.—*Aug. 8*. The black walnut worm (Datana integerrima Gr. & Rob.) was very abundant in this section and has defoliated a number of trees. The fall webworm (Hyphantria textor Harr.) is also somewhat injurious.—*Aug. 24*

**Dutchess county** [Henry D. Lewis, Annandale] — Oyster scale (Lepidosaphes ulmi Linn.) and scurfy scale (Chionaspis furfura Fitch) continue abundant and rather destructive, particularly on young trees. The San José scale (Aspidiotus perniciosus Comst.) is well established and injurious in the vicinity of Germantown.—*May 14*. The bud moth (Tmetocera ocellana Schiff.) is moderately numerous and green apple aphids appeared the past week. Cutworms are quite numerous and the small cucumber flea beetle (Epitrix cucumeris Harr.) is abundant. Rose beetles (Macrodactylus subspinosus Fabr.) and cutworms are very prevalent.— *May 26*. Potato beetles (Doryphora decimlineata Say) have become quite numerous the past week and the same is true of the striped squash beetle (Diabrotica vittata Fabr.) and the cucumber flea beetle (Epitrix cucumeris Harr.). Scurfy and oyster scale continue abundant.—*June 9*. Aphids have been quite numerous in this immediate sec-

tion, though not so abundant as last year. Currant worms (Pteronus ribesii Scop.) appeared later than usual and in considerable numbers. Potato beetles are more abundant than for several years, possibly due to neglect in poisoning the vines, owing to the relative scarcity of the pest during the last two years. The work of the elm leaf beetle (Galerucella luteola Müll.) is apparent though not very marked.— *July 3*

**Genesee county** [J. F. Rose, South Byron]— Asparagus beetles (Crioceris asparagi Linn.) appeared May 15, potato beetles (Doryphora decim-lineata Say) the 18th. No tent caterpillars (Malacosoma americana Fabr.) have been observed. Aphids are abundant on roses.— *May 2.* Cabbage maggots (Phorbia brassicae Bouché) are at work as usual; we have found that a couple of moth balls placed next to each plant when set, is an excellent protective. Asparagus beetles are very abundant and striped cucumber beetles (Diabrotica vittata Fabr.) are numerous.— *May 11.* Asparagus beetles are more abundant than usual and a cabbage butterfly (Pontia rapae Linn.) was observed May 23.—*May 28.* Two nests of fall webworms (Hyphantria textor Harr.) were observed July 9. Potato beetles (Doryphora decimlineata Say) have been rarer than in many years. Only one squash bug (Anasa tristis DeG.) has been observed. Cabbage worms are present in smaller numbers.— *July 17*

**Herkimer county** [George S. Graves, Newport] — Tent caterpillars (Malacosoma americana Fabr.) were first observed May 17 and a few nests were seen the following day.— *May 28.* Currant worms (Pteronus ribesii Scop.) were half grown June 3. No potato beetles (Doryphora decimlineata Say) have been observed. Horn flies (Haematobia serrata Rob.-Desv.) are quite abundant on cattle.— *June 5.* These latter insects are reported by farmers as being generally abundant and very annoying to cattle. Cabbage worms (Pontia rapae Linn.) were rather numerous in early cabbage.— *July 31.* Fall webworms (Hyphantria textor Harr.) were observed on a plum. The black walnut worm (Datana integerrima Gr. & Rob.) has been very destructive to black walnut, defoliating many trees. Very few potatoes in gardens next to sod ground have been affected by wireworms.— *Aug. 15.* Yellow-necked apple worms (Datana ministra Walk.) are full grown and have caused considerable injury to the foliage. Horn flies continue

abundant and grasshoppers are numerous though they have not caused much injury.— *Aug. 28*

**Suffolk county** [F. E. Lutz, Cold Spring Harbor] — Cabbage butterflies (Pontia rapae Linn.) were first observed April 14. The brown and black woolly bear (Isia isabella Abb. & Sm.) has been observed crawling every month during the winter.— *Apr. 19.* Adults of the green striped grasshopper (Chortophaga viridifasciata DeG.) were observed May 2. The form infuscata appears to be relatively more abundant than usual. This is more southern than the green variety. Possibly the warm weather had something to do with this though it is doubtful. — *May 9.* The dark-sided cut worm (Paragrotis messoria Harr.) has been quite abundant and destructive, in particular to evening primroses. The periodical cicada (Tibicen septendecim Linn.) has appeared in this section.— *May 30*

**Warren county** [C. L. Williams, Glens Falls] — Cutworms have been very abundant and tent caterpillars (Malacosoma americana Fabr.) more numerous than for several years past. The larder beetle (Dermestes lardarius Linn.) has been somewhat plentiful about houses.— *June 3*

**Westchester county** [Frank R. Calkins, Ossining] — The elm leaf beetle (Galerucella luteola Müll.) has been more destructive than in any previous year, owing to the utter lack of repressive measures. "Nearly every tree in town has been completely defoliated and now the second crop of leaves has been attacked and is nearly eaten by the young larvae."— *July 30*

**Wyoming county** [W. H. Roeper, Wyoming] — The first tent caterpillars (Malacosoma americana Fabr.) were observed May 12, though not in large numbers. The wheat sawfly (Cephus occidentalis Riley & Marl.) has been inflicting considerable injury. The codling moth (Carpocapsa pomonella Linn.) has been rather abundant on apples, and canker worms are causing a great deal of injury.— *June 11*

## LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the Entomologist during the year 1906. Seventy-four are given with the title,[1] place, time of publication and a summary of the contents of

[1] Titles are given as published, and in some instances they have been changed or supplied by the editors of the various papers.

each. Volume and page number are separated by a colon, the first superior figure gives the column and the second the exact place in the column in ninths: e. g. $70{:}956^{36}$ means volume 70, page 956, column 3, in the sixth ninth, i. e. about two thirds of the way down.

Oyster Scale. Country Gentleman, Oct. 19, 1905, $70{:}956^{36}$

Brief economic notice of the oyster scale, Lepidosaphes ulmi Linn.

The Moth Situation. Country Gentleman, Oct. 19, 1905, $70{:}962^{41}\text{–}63^{29}$

Brief summary of conditions in eastern Massachusetts, with special reference to the gipsy moth, Porthetria dispar Linn. and the brown tail moth, Euproctis chrysorrhoea Linn. with a discussion of repressive measures.

Mosquitos and Nature Study. N. Y. S. E. D.

Science Division Folder, p. 1–8.

Issued Oct. 20, 1905.

The importance of these insects and their availability for nature study is pointed out.

20th Report of the State Entomologist 1904. N. Y. State Mus. Bul. 97, Entomology 24, p.357–597, pl. 19

Advance copies issued Oct. 30, 1905.

*Contents*



Wood Lice. Country Gentleman, Nov. 2, 1905, $70{:}1004^{37}$

Brief general notice with discussion of remedial measures.

Jassidae of New York State by Herbert Osborn. Reprint from N. Y. State Mus. Bul. 97, 20th State Entomologist Rep't 1904. p.498–545

Issued Nov. 8, 1905.

List of Hemiptera Taken in the Adirondack Mountains by E. P. Van Duzee. Reprinted from N. Y. State Mus. Bul. 97, 20th State Entomologist Rep't 1904. p.546–56

Issued Nov. 8, 1905.

List of Lepidoptera Taken at Keene Valley, N. Y. by G. F. Comstock. Reprinted from N. Y. State Mus. Bul. 97, 20th State Entomologist Rep't 1904. p.557–61

Issued Nov. 8, 1905.

Warble and Bot Flies. New York Farmer, Dec. 7, 1905, p.4

Brief accounts of the horse bot fly, Gastrophilus equi Clark, the heel fly, Hypoderma lineata Vill. and the sheep bot fly or maggot, Oestrus ovis Linn.

A Winter Campaign Against Scale Insects. Garden Magazine, Jan. 1906, 2:270

Brief general notices of West Indian peach scale, Aulacaspis pentagona Targ.; oyster scale, Lepidosaphes ulmi Linn. and scurfy scale, Chionaspis furfura Fitch with discussion of remedies.

Appletree Pests. Garden Magazine, Feb. 1906, 2:36,38

Brief popular economic notices are given of the following species: Roundheaded borer, Saperda candida Fabr., bud moth, Tmetocera ocellana Schiff., pistol case-bearer, Coleophora malivorella Riley and cigar case-bearer, C. fletcherella Fern.; tent caterpillar, Malacosoma americana Fabr. and codling moth, Carpocapsa pomonella Linn.

Box Elder Plant Bug. Suburban Life, Feb. 1906, 2:86[24]

Methods of controlling the box elder plant bug, Leptocoris trivittatus Say are discussed briefly.

Scale in Orchard. Country Gentleman, Feb. 1, 1906, 71:114[22]

Remedies for San José scale, Aspidiotus perniciosus Comst.

Bordeaux Mixture for Potatoes. Country Gentleman, Feb. 15, 1906, 71:157[43]

Directions for the preparation and application of poisoned bordeaux mixture.

Remedies for Scale. Country Gentleman, Feb. 15, 1906, 71:162[12]

Brief comments on lime-sulfur washes and the probable value of so called soluble oils for controlling San José scale, Aspidiotus perniciosus Comst.

Scale in Orchard. Country Gentleman, Feb. 22, 1906, 71:184[35]

Directions for spraying orchard trees infested by San José scale, Aspidiotus perniciosus Comst. with lime-sulfur wash.

Bag Worm. Country Gentleman, Feb. 22, 1906, 71:185[12]

Spraying with an arsenical poison or hand picking recommended for the control of the bagworm, Thyridopteryx ephemeraeformis Haw.

Spraying Calendar. Suburban Life, Mar. 1906, 2:144–45

Summarized directions for the control of the more important fruit and garden pests.

Poison Formulas. Suburban Life, Mar. 1906, 2:145–46

Formulas for the standard insecticides and fungicides.

Insects Affecting Park and Woodland Trees. N. Y. State Mus. Mem. 8. 1905. 1:1–332, a333–a459, 48 pl. (20 colored), 63 text fig.

Issued Feb. 23, 1906.

*Contents*



Salt is Useless. Country Gentleman, Mar. 8, 1906, 71:232[43]

Salt has very little or no value in the lime-sulfur wash.

Diversities Among New York Mosquitos. Reprint from Am. Mosquito Extermination Soc. Year Book 1904–1905 (p.34–64) Mar. 1906, p.1–32, pl.14

Issued Mar. 9.

A summarized discussion of the biologic and morphologic diversities obtaining among native species.

Lime-sulfur Formulae. Country Gentleman, Mar. 15, 1906, 71:256[25]

Formulas for boiled and unboiled lime-sulfur washes.

Bag Worms Not Easily "Bagged." Country Gentleman, Mar. 15, 1906, 71:258[12]

Timely and thorough spraying with an arsenical poison should be very effective in controlling bagworms, Thyridopteryx ephemeraeformis Haw.

Producing Smooth Potatoes. Country Gentleman, Mar. 22, 1906, 71:277[11]

General directions for controlling insect enemies and fungous diseases.

Petroleum for Scale. Country Gentleman, Mar. 22, 1906, 71:281[15]

Comments on the value of oil preparations for the control of San José scale, Aspidiotus perniciosus Comst. with special reference to "soluble oils" and their effects on trees.

Insect Enemies of Ornamental Trees. Suburban Life, May 1906, 2:248-50

Brief descriptive accounts giving control measures for the following species: maple borer, Plagionotus speciosus Say; elm borer, Saperda tridentata Oliv.; leopard moth, Zeuzera pyrina Fabr.; carpenter worm, Prionoxytus robiniae Peck; poplar borer, Saperda calcarata Say; mottled willow borer, Cryptorhynchus lapathi Linn.; locust borer, Cyllene robiniae Forst; white marked tussock moth, Hemerocampa leucostigma Abb. & Sm.; fall webworm, Hyphantria textor Harr.; forest tent caterpillar, Malacosoma disstria Fabr.; gipsy moth, Porthetria dispar Linn.; brown tail moth, Euproctis chrysorrhoea Linn.; bagworm, Thyridopteryx ephemeraeformis Haw.; elm leaf beetle, Galerucella luteola Müll.; elm case bearer, Coleophora limosipennella Dup.; San José scale, Aspidiotus perniciosus Comst.; cottony maple scale, Pulvinaria innumerabilis Rathv.; false maple scale, Phenacoccus acericola King; black-banded scale, Eulecanium nigrofasciatum Perg. and the oyster scale, Lepidosaphes ulmi Linn.

Gipsy and Brown Tail Moths. N. Y. State Fruit Growers Ass'n Proc. 1906, p.71-77

Brief summarized discussion of Porthetria dispar Linn. and Euproctis chrysorrhoea Linn.

Injurious Insects of 1905. N. Y. State Fruit Growers Ass'n Proc. 1906, p.120-24

Brief notice of shade tree situation followed by observations on the codling moth, Carpocapsa pomonella Linn.; apple maggot, Rhagoletis pomonella Walsh; rose beetle, Macrodactylus subspinosus Fabr.; scurfy scale, Chionaspis furfura Fitch; San José scale,

Aspidiotus perniciosus Comst.; grape root worm, Fidia viticida Walsh and the berry moth, Polychrosis viteana Clem.

New York Entomologic Service. Country Gentleman, May 17, 1906, 71:472[48]–73[11]; New York Farmer, May 17, p.5

Summary of reports and a warning notice.

Fighting Garden Pests. Suburban Life, June 1906, 2:293

Control measures for cutworms, black flea beetles, Epitrix cucumeris Harr.; currant worms, Pteronus ribesii Scop.; rose beetles, Macrodactylus subspinosus Fabr.; oyster and scurfy scales, Lepidosaphes ulmi Linn. and Chionaspis furfura Fitch.

Red Ants. Suburban Life, June 1906, 2:301–2

Directions are given for fighting this tiny pest, Monomorium pharaonis Linn.

Grape Root Worm Found to be Very Abundant. Grape Belt, May 29, 1906, p.1

General observations on the work of the grape root worm, Fidia viticida Walsh.

New York Entomologic Service. Country Gentleman, June 7, 1906, 71:545[23]; New York Farmer, June 7, p.4

Summary of reports.

New York Entomologic Service. Country Gentleman, June 14, 1906, 71:569[15]; New York Farmer, June 14, p.4

Summary of reports.

Melon Pests. Country Gentleman, June 21, 1906, 71:592[45]

Covering young plants with netting is advised for striped cucumber beetle, Diabrotica vittata Fabr. or land plaster, ashes etc. may be applied when the dew is on.

Cherry Borers. Country Gentleman, June 21, 1906, 71:593[15]

Cut away diseased bark and kill the borers either with a wire or by injecting carbon bisulfid. Then cover the wounds with paint or fill the cavity with cement.

New York Entomologic Service. Country Gentleman, June 21, 1906, 71:593[27]; New York Farmer, June 21, p.8

Summary of reports.

Ravages of Tussock Caterpillars. Troy Times, June 22, 1906; Argus [Albany], June 23; Lockport Journal, June 23; Syracuse Post-Standard, June 23; Utica Press, June 23; Ogdensburg News, June 24; Cohoes Dispatch, June 25; Middletown Argus, June 25; Hudson Republican, June 28; Albany Press-Knicker-

bocker, June 29; Washington County Post, June 29; Boonville Herald, July 5.

A brief account of the work of the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm. in cities and villages in New York State with directions for suppressing the pest.

An Enemy to Grass and Corn. The So-called Grass Webworm. Country Gentleman, June 28, 1906, 71:612[12].

Brief notice of injury with a summary of remedial and preventive measures for grass webworm, Crambus vulgivagellus Clem. and associated species.

Rose Beetles. Country Gentleman, June 28, 1906, 71:614[47]

Preventive measures for rose beetles, Macrodactylus subspinosus Fabr. are discussed briefly.

New York Entomologic Service. Country Gentleman, June 28, 1906, 71:622[36]; New York Farmer, June 28, p.5

Summary of reports.

Rose Bugs. Country Gentleman, July 5, 1906, 71:635[15]

Suppressive measures for the control of Macrodactylus subspinosus Fabr. are given.

Crude Carbolic Acid for Scale. Country Gentleman, July 5, 1906, 71:636[24]

Comments on the probable value of this material for the control of San José scale, Aspidiotus perniciosus Comst. Adherence to the lime-sulfur wash advised for the present.

Hair Snakes or Cut Worms. Country Gentleman, July 5, 1906, 71:643[25]

Brief accounts of hair snakes, cutworms and onion maggots are given in reply to a vague inquiry.

Gipsy and Brown Tail Moth

Issued July 9, 1906.

A warning placard giving the salient characteristics of these two species, Porthetria dispar Linn., Euproctis chrysorrhoea Linn. and illustrating them in colors.

Protect the Trees. Albany Press-Knickerbocker, July 9, 1906; Troy Budget, July 8; Troy Times, July 9; Troy Press, July 9 and July 16; Troy Standard, July 10

Urges the adoption of remedial measures against the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm. and elm leaf beetle, Galerucella luteola Müll.

The Gipsy and Brown Tail Moths. N. Y. State Mus. Bul. 103, Entomology 25. 1906.

Issued July 14, p. 1–20, pl. 1–10.

*Contents*



The Moth Situation. Country Gentleman, July 19, 1906, 71:681[11]

Summary account of the work against the gipsy moth, Porthetria dispar Linn. and the brown tail moth, Euproctis chrysorrhoea Linn. in the vicinity of Boston, Mass.

Grape Root Worm. Grape Belt (Dunkirk, N. Y.) July 24, 1906, p.5; Jamestown Journal, July 25

Summary of present conditions. Serious injury is anticipated in some of the vineyards most infested by Fidia viticida Walsh and good culture is urged.

New York Entomologic Service. Country Gentleman, July 26, 1906, 71:694[48]; New York Farmer, July 26, p.4

Summary of reports.

Ants in Lawn. Suburban Life, Aug. 1906, 3:90[32]

Carbon bisulfid treatment recommended.

Currant Aphids. Suburban Life, Aug. 1906, 3:90[34]

Spraying with contact insecticides advised for currant aphids, Myzus cerasi Fabr.

Albany's Trees. Albany Evening Journal, July 26, 1906, p.12

Summarized account of the local injuries by the elm leaf beetle, Galerucella luteola Müll. and the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm. with discussion of control methods. The employment of a forester is advocated.

Save the Trees. Mechanicville Mercury, July 28, 1906

A brief notice calling attention to the work of the elm leaf beetle, Galerucella luteola Müll. and urging concerted action for its suppression.

Cornstalk Borers. Country Gentleman, Aug. 2, 1906, 71:714[35]

Crambids, Crambus sp.; stalk borer, Papaipema nitela Guen. and billbugs, Sphenosphorus sp. are briefly discussed as possible authors of the mischief.

Cucumber Insects. Country Gentleman, Aug. 2, 1906, 71:715[37]

Remedial measures are given for cutworms and the striped cucumber beetle, Diabrotica vittata Fabr.

New York Entomologic Service. Country Gentleman, Aug. 2, 1906, 71:722[43]; New York Farmer, Aug. 2, p.8

Summary of conditions.

As to the Gipsy Moth. Providence (R. I.) Journal, Aug. 4, 1906

Statements respecting the gipsy moth, Porthetria dispar Linn. and observations on the necessity of protecting trees from insect pests.

Protecting the City's Shade Trees. Albany Argus, Aug. 8, 1906

A brief statement emphasizing the value of individual action against the white marked tussock moth, Hemerocampa leucostigma Abb. & Sm. and the elm leaf beetle, Galerucella luteola Müll.

Tulip Tree Scale. Country Gentleman, Aug. 16, 1906, 71:754[45]

Eulecanium tulipiferae Cook is described and repressive measures advised.

Currant Aphis-Asparagus. Country Gentleman, Aug. 23, 1906, 71:775[11]

Remedies for currant aphis, Myzus cerasi Fabr. are briefly discussed.

Squash and Cucumber Pests. Country Gentleman, Aug. 30, 1906, 71:800[44]

Brief economic accounts of the squash borer, Melittia satyriniformis Hübn. and the striped cucumber beetle, Diabrotica vittata Fabr.

Protect the Birds. Cattaraugus Republican, Aug. 31, 1906

A brief plea for the protection of birds as one of the best methods of controlling certain destructive forest insects.

21st Report of the State Entomologist 1905. N. Y. State Mus. Bul. 104, Entomology 26, p.47-186, 48 fig. 10 pl.

Issued Sept. 4, 1906.

*Contents*

The Shade Tree Problem in New York State. Reprint from N. Y. State Mus. Bul. 104, 21st State Entomologist Rep't 1905. 1906. p.105–9, 2 pl.

A plea for the better protection of shade trees.

Mosquito Control. Reprint from N. Y. State Mus. Bul. 104, 21st State Entomologist Rep't 1905. 1906. p.109-16, 8 pl.

A summary account of mosquitos with a discussion of control methods.

Oyster Scale. Country Gentleman, Sept. 20, 1906, 71:872[27]

Brief economic notice of the oyster scale, Lepidosaphes ulmi Linn.

Black Flea Beetle. Country Gentleman, Sept. 20, 1906, 71:872[35]

Remedial measures are given for the black flea beetle, Epitrix cucumeris Harr.

Horticultural Diseases and Pests. N. Y. State Lib. Bul. 29e. 1906. p.77-79

Issued Sept. 24.
Review and summary of legislation for 1905.

Notes for 1905 from New York. U. S. Dep't Agric. Bur. Ent. Bul. 60, 1906, p.89–90

Brief observations are given on the following species: Webworms, Crambus vulgivagellus Clem.; army worm, Heliophila unipuncta Haw.; codling moth, Carpocapsa pomonella Linn.; apple maggot, Rhagoletis pomonella Walsh; rose beetle, Macrodactylus subspinosus Fabr.; scurfy scale, Chionaspis furfura Fitch; grape root worm, Fidia viticida Walsh; spittle insects, Philaenus lineatus Linn. and P. spumaria Linn.; white marked tussock moth, Hemerocampa leucostigma Abb. & Sm.; fall webworm, Hyphantria textor Harr.; elm leaf beetle, Galerucella luteola Müll.; elm case-bearer, Coleophora limosipennella Dup.; false maple scale, Phenacoccus acericola King; woolly maple leaf aphid, Pemphigus acerifolii Riley and the green-headed horsefly, Tabanus lineola Fabr.

Experiments with Insecticides on the San José Scale. U. S. Dep't Agric. Bur. Ent. Bul. 60, 1906, p.137–38

Experiments with lime-sulfur washes and the so called K-L mixtures are briefly summarized as being decidedly in favor of the lime-sulfur washes for work against Aspidiotus perniciosus Comst.

San José Scale. Country Gentleman, Oct. 4, 1906, 71:921[11]

Thorough spraying with a lime-sulfur wash, preceded by pruning, is advised for San José scale, Aspidiotus perniciosus Comst.

Pear Blister Mite. Country Gentleman, October 11, 1906, 71:944[36]

Remedial measures are given for the pear blister mite, Eriophyes pyri Nal.

## CONTRIBUTIONS TO COLLECTION OCT. 16, 1905-OCT. 13, 1906

The following list of acquisitions is limited mostly to species of importance, either on account of their relative scarcity or because of their injurious nature, since it was deemed inadvisable to include in this list a number of very common forms received yearly and accompanied by no data of special value.

### DONATION

#### Hymenoptera

Bembex pallidipicta Sm., cocoons, Sept. 11, **J. B. Woodworth,** Fort Edward, N. Y.

Cratotechus sp., adults, Aug. 20, **Miss S. J. Russell,** Blue Point, L. I., N. Y.

Aulax glechomae Htg., galls on Glechoma hederacea Linn., June 20, **S. H. Burnham,** Albany, N. Y.

Neuroterus batatus Fitch, oak potato gall, gall on white oak, Sept. 15, **S. H. Burnham,** S. E. Easton Hills, N. Y.

Andricus lana Fitch, oak wool gall, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

A. petiolicola Bass., oak leaf stalk gall, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

A. seminator Harr., wool sower, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

A. singularis Bass., oak leaf apple, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

Amphibolips confluentus Harr., large oak apple, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

A. ilicifoliae Bass., black scrub oak gall, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

Harpiphorus tarsatus Say, larvae on Cornus, Sept. 20, **L. S. Silliman,** Old Chatham, N. Y.

Pontania pomum Walsh, willow apple gall, gall on heart-leaved willow, Sept. 15, **S. H. Burnham,** S. E. Easton Hills, N. Y.

Kaliosysphinga ulmi Sund., elm leaf miner, larva on Camperdown or weeping elm, June 10, **Barton C. Meays,** Baldwinsville, N. Y.

### Coleoptera

Tomicus balsameus Lec., balsam bark borer, adult, June 22, **E. P. VanDuzee,** Buffalo, N. Y.

Calandra granaria Linn., grain weevil, adults, Oct. 19, **J. J. Barden,** Stanley, N. Y.

Systena hudsonias Frost, black headed flea beetle, adult on grape, July 30, **Will E. Skinner,** Portland, N. Y.

Galerucella luteola Müll., elm leaf beetle, larvae on elm, July 9, **A. R. Wing,** Fort Edward, N. Y.

Saperda candida Fabr., round headed appletree borer, adults and larvae on apple, June 19, **T. F. Niles,** Chatham, N. Y.

Phymatodes amoenus Say, grapevine Phymatodes on grapevine, Mar. 19, **P. L. Huested,** Blauvelt, N. Y.

Euphoria inda Linn., bumble flower beetle, adult, Aug. 29, **A. M. Loomis,** Dunkirk, N. Y. Same, Sept. 7, **L. M. Olmsted,** Jamestown, N. Y.

Macrodactylus subspinosus Fabr., rose beetle, adults on grape, June 16, **D. K. Falvay,** Westfield, N. Y.

Hadrobregmus errans Melsh., adult on pine, Sept. 10, **Chauncey Posson,** Albany, N. Y. (Boring in pine beam)

Dytiscus harrisii Kirby, margined water beetle, adult, Nov. 29, **George L. Fredrick,** Albany, N. Y.

### Diptera

Rhagoletis pomonella Walsh, apple maggot, larvae in apple, Sept. 5, **C. W. Stuart,** Newark, N. Y.

Scenopinus fenestralis Linn., carpet fly, larva, May 2, **C. E. Eldredge,** Leon, N. Y.

Anopheles maculipennis Meig., malarial mosquito, male and female, July 14, **C. S. Ludlow,** Ft Logan, Ark.

A. punctipennis Say, Apr. 17, **C. R. Pettis,** Saranac Junction, N. Y. (Through Forest, Fish and Game Com'n)

Culicada cantator Coq., brown salt marsh mosquito, living larvae, May 18, **John R. Lott,** Brooklyn, N. Y.

C. sollicitans Walk., salt marsh mosquito, Aug. 13, **H. C. Weeks,** Bayside, L. I., N. Y.

Culiseta absobrinus Felt, larvae, Aug. 2, **H. C. Weeks,** Paul Smith's, N. Y.

Culex pipiens Linn., house mosquito, larvae, pupae and adults, Dec 13, **J. H. Ashworth,** Edinburgh, Scotland.

C. restuans Theo., white spotted mosquito, adult, Sept. 12, **J. G. Needham,** Lake Michigan

C. hassardii Gbhm., adults and larvae, July 2, **M. Grabham,** Jamaica, W. I.

C. microannulatus Theo., adults (male and female), July 14, **C. S. Ludlow,** Washington, D. C.

C. gelidus Theo., adults (female), July 14, **C. S. Ludlow,** Washington, D. C.

Stegomyia mediovittata Coq., adults and larvae, July 2, **M. Grabham,** Jamaica, W. I.

S. arnesii Ludlow, adults (male and female), July 14, **C. S. Ludlow,** Washington, D. C.

Mansonia uniformis Theo., adult, Nov. 14, **Andrew Balfour,** Khartoum, Africa.

Wyeomyia smithii Coq., pitcher plant mosquito, larvae in pitcher plant, May 7, **L. H. Joutel,** Lakehurst, N. J.

Finlaya porcilia Theo., female, July 14, **C. S. Ludlow,** Washington, D. C.

Mochlostyrax jamaicensis Gbhm., adults and larvae, July 2, **M. Grabham,** Jamaica, W. I.

Myzomyia thorntonii Ludlow, adult (female, cotype), July 14, **C. S. Ludlow,** Washington, D. C.

Howardina aureostriata Gbhm., adults and larvae, July 2, **M. Grabham,** Jamaica, W. I.

Eucorethra underwoodi Undw., giant mosquito, larvae, Aug. 2, **H. C. Weeks,** Paul Smith's, N. Y.

Corethrella appendiculata Gbhm., adults and larvae, July 2, **M. Grabham,** Jamaica, W. I.

Contarinia violicola Coq., violet gall midge, larvae on violet, Oct. 10, **L. Haines,** Rhinebeck, N. Y.

Tipula sp., crane fly, Apr. 17, **C. R. Pettis,** Saranac Junction, N. Y. (Through Forest, Fish and Game Com'n)

### Lepidoptera

Polygonia interrogationis Fabr., hop merchant, larvae on elm, July 29, **Miss Louise E. Swartz,** Dahlia, N. Y.

Satyrodes canthus Linn., adult, July 21, **F. S. Dibb,** Ushers, N. Y.

Sphecodina abbotii Swainson, larvae on woodbine, July 13, **W. J. Guernsey,** Albany, N. Y.

Pholus pandorus Hübn., adult, July 19, **W. S. Hamlin,** Glenville, N. Y.

P. achemon Drury, larva, July 19, **A. G. Appleton,** Albany, N. Y.

Ampelophaga myron Cramer, grapevine sphinx, larva on grape, Aug. 21, **Lee Richardson,** Rome, N. Y.

Phlegethontius quinquemaculata Haw., tomato worm, adult, Sept. 13, **N. Albert Sehoenbuch,** Stapleton, New York, N. Y.

Sphinx drupiferarum Abb. & Sm., adult, June 10, **George S. Graves,** Newport, N. Y.

Smerinthus jamaicensis Drury, adult, July 18, **Editor, Avon Herald,** Avon, N. Y.

Citheronia regalis Fabr., hickory horned devil, caterpillar, Sept. 13, **Alex More,** Rockville Center, L. I., N. Y.

Estigmene acraea Drury, larvae, Sept. 5, **Charles Hosie,** Ferndale, N. Y.

Apatela americana Harris, larva on maple, Aug. 20, **S. J. Russell,** Blue Point, L. I., N. Y.

A. interrupta Guen., larvae, Aug. 28, **M. W. VanDenburg,** Mt Vernon, N. Y.

Arsilonche albovenosa Goeze, adult, June 10, **George S. Graves,** Newport, N. Y.

Hadena arctica Boisd., cutworm, adult, July 28, **M. Gabriel,** Mileses, N. Y.

Peridroma margaritosa Haw., variegated cutworm, larvae, July 25, **J. M. Erwin,** New Salem, N. Y. One light army worm, Heliophila unipuncta Haw.

Paragrotis messoria Harris, dark sided cutworm, larvae, May 30, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y. Same, June 1, **S. C. Martin,** Schenectady, N. Y.

Mamestra adjuncta Boisd., adult, May 21, **F. A. Fitch,** Randolph, N. Y.

Papaipema nitela Guen., larvae, June 26, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

Catocala relicta Walk., moth, Sept. 20, **C. N. Stevens,** South Gilboa, N. Y.

C. grotiana Bailey, Aug. 13, **Alice E. Bartlett,** Delhi, N. Y.

Hemerocampa leucostigma Abb. & Sm., white marked tussock moth, caterpillar, July 26, **C. F. Van Horne,** Glen, N. Y. Same larva on maple, Aug. 2, **E. B. Frey,** Palatine Bridge, N. Y. Same, female, Aug. 18, **C. R. Pettis,** Saranac Junction, N. Y.

Paleacrita vernata Pack., spring cankerworm, larva on apple, June 4, **L. Emmett Holt,** New York city.

Earias insulana Boisd., eggs, larvae, adult on cotton, Dec. 23, **F. V. Theobald,** Egypt, Africa.

?Oiketicus abbotii Grote, southern bagworm on cyprus, Jan. 8, **Hermann Von Schrenk,** New Orleans, La.

Thyridopteryx ephemeraeformis Haw., bagworm on cedar, Jan 8, **Hermann Von Schrenk,** New Orleans, La. Same, probably on mangrove near Palm Beach, Fla., Jan. 22, **Hermann Von Schrenk,** St Louis, Mo. Same, Apr. 3, **L. V. Case,** Tarrytown, N. Y. Same, cocoon and pupa, Sept. 7, **Miss Helen Weston,** West New Brighton, Staten Island, N. Y.

Sibine stimulea Clem., saddle back caterpillar, larva, Aug. 16, **Mekeel Bros.,** Yorktown Heights, N. Y. (Through Agricultural Department)

Euclea delphinii Boisd., slug caterpillar, larvae, Sept. 4, **F. N. Beebe,** Walton, N. Y.

Zeuzera pyrina Linn., leopard moth, larvae on maple, Sept. 7, **Miss Helen Weston,** West New Brighton, Staten Island, N. Y.

Sesia pictipes Gr. & Rob., larvae on plum, June 15, **F. P. Wilson,** Schenectady, N. Y.

?Thiodia, species on oak, May 24, **L. H. Joutel,** New York city.

Eulia politana Haw., pine tube builder on white pine needles, Jan. 10, **Robert L. Stevens,** Westbury, L. I., N. Y.

Anarsia lineatella Zell., peach twig moth on cherry, Oct. 23, **C. Kennedy,** Coxsackie, N. Y.

Coptodisca splendoriferella Clem., resplendent shield bearer, work, Sept. 30, **H. W. Covert,** Waterford, N. Y.

Crambus sp., grass webworms, larvae on corn, June 14, **Lansing A. Dick,** Germantown, N. Y.

### Corrodentia

Psocus venosus Burm., Psocus or book louse, nymphs on maple, Aug. 1, **F. P. Hochstrasser,** Berne, N. Y. Same, adult on maple, Aug. 8, **J. N. Wright,** Grand Gorge, N. Y. Same, Aug. 13, **J. M. Graeff,** Westport, N. Y.

### Neuroptera

Chrysopa sp., eggs on apple, Sept. 18, **J. F. Rose,** South Byron, N. Y.

Corydalis cornuta Linn., devil fly or horned corydalis, adult, July 14, **G. G. Blakeslee,** Rensselaer, N. Y.

Chauliodes pectinicornis Linn., comb horned fish fly, adult, July 28, **E. F. Connally,** Troy, N. Y.

### Hemiptera

Tibicen septendecim Linn., periodical cicada, adult, May 28, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y. Same, adult, June 12, **H. D. Smith,** Center Moriches, L. I., N. Y.

Belostoma americanum Leidy., Apr. 19, **Thomas Barry,** Albany, N. Y.

Phylloxera caryae-globuli Walsh, June 4, **F. E. Lutz,** Cold Spring Harbor, L. I., N. Y.

Schizoneura americana Riley, young and adults on elm, June 22, **Julius G. Linsley**, Oswego, N. Y.

Callipterus ulmifolii Mon., elm leaf aphis, work on elm, July 24, **Rev. G. H. Purdy,** Warrensburg, N. Y.

Chermaphis abietis Linn., spruce gall aphid, galls, June 20, **James M. Andrews,** Schenectady, N. Y.

Aleyrodes betheli Ckll. MS., on Berberis, Sept. 27, **T. D. A. Cockerell,** Ouray, Col.

Chermes pinicorticis Fitch, pine bark aphid, hatching young on pine, May 29, **C. R. Pettis,** Saranac Junction, N. Y.

Parlatoria proteus Curt., on Japanese orange, Jan. 4, **J. R. Anderson,** Victoria, B. C.

Chrysomphalus rossi Mask., Sept. 27, **T. D. A. Cockerell,** Lucban, P. I.

Pseudaonidia duplex Ckll., on orange from Japan, Dec. 18, **J. R. Anderson,** Victoria, B. C.

Aspidiotus rapax Comst., greedy scale on California lemon, Jan. 4, **J. R. Anderson,** Victoria, B. C.

A. perniciosus Comst., San José scale on Keiffer pear, Jan. 28, **A. G. Wheeler jr,** New York city. Same, on pear, Mar. 10, **F. E. Goewey,** East Greenbush, N. Y. Same, young on apple, Apr. 28, **William H. Hart,** Arlington, N. Y. Same, young, May 15, **H. A. Van Fredenberg,** Port Jervis, N. Y. Same, female on plum and apple, May 21, **E. C. and F. M. Brooks,** Athens, N. Y. Same, females on apple, May 26, **J. A. Otterson,** Maynard, Mass. Same, on osage orange, June 28, **W. K. Post,** Bayport, L. I., N. Y. Same, adults and young on pear, July 16, **Alexander Sitcer,** Valatie, N. Y. Same, adults and young on plum, July 25, **Samuel T. Maynard,** Northboro, Mass. Same, young and adults on apple,

July 31, **Henry Gorman,** Huntington, N. Y. Same, young and adults on currant, Aug. 2, **Mrs H. A. Sterling,** Scotia, N. Y. Same, adults and young on pear, Aug. 4, **A. V. Boak,** Middletown, N. Y. Same, on currant, Aug. 13, **M. S. Wheeler,** Berlin, Mass. Same, young and adults on crab apple, Oct. 3, **I. Osgood Carleton,** Yonkers, N. Y.

A. hederae Vallot, white ivy scale, adults and young on ivy, Oct. 5, **Henry G. Dorr,** Boston, Mass. Same, Apr. 21, **B. D. Van Buren,** Lockport, N. Y.

A. ancylus Putn., adult on apple, Jan. 15, **Reuben Moore,** Chatham, N. Y.

Hemichionaspis minor? Mask., on orange from Japan, Dec. 18, **J. R. Anderson,** Victoria, B. C.

Aulacaspis rosae Bouché, rose scale on rose, Apr. 3, **Fred Bostwick,** Poughkeepsie, N. Y. Same, on blackberry, Aug. 13, **M. S. Wheeler,** Berlin, Mass.

Diaspis carueli Targ., juniper scale, adult on Pinus aristata and Juniperinus virginiana, Apr. 16, **John Dunbar,** Rochester, N. Y.

Chionaspis pinifoliae Fitch, scurfy pine scale on Scotch pine needles, Jan. 10, **Robert L. Stevens,** Westbury, L. I., N. Y.

Eulecanium tulipiferae Cook, tulip tree scale, adult on tulip, July 27, **Herbert Mead,** Lake Waccabuc, N. Y. Same, young and adults on tulip, Sept. 17, **Miss F. E. Fellows,** Norwich, Ct.

E. nigrofasciatum Perg., black-banded scale on maple, Sept. 13, **T. F. Niles,** Chatham, N. Y.

Coccus diversipes Ckll., on fern, Sept. 27, **T. D. A. Cockerell,** Lucena, P. I.

Pseudophilippia quaintancii Ckll., woolly pine scale, adults on pitch pine, Nov. 20, **H. A. Van Fredenberg,** Port Jervis, N. Y.

Pulvinaria innumerabilis Rathv., cottony maple scale, adults and young on Virginia creeper, July 3, **Charles M. Pierce,** Adams, N. Y.

Phenacoccus acericola King, false maple scale, adults and young on maple, July 24, *New York Farmer* (**H. A. Van Fredenberg**) Port Jervis, N. Y. Same, larvae on maple, Sept. 18, **Edward F. Studwell,** Port Chester, N. Y.

### Orthoptera

Oecanthus niveus DeG., white flower cricket, eggs on grape, Apr. 30, **F. A. Morehouse,** Ripley, N. Y.

Gryllotalpa borealis Burm., mole cricket, adult, Oct. 8, **William Williams,** Milton, N. Y.

Diapheromera femorata Say, walking stick, adult, Oct. 12, **George L. Richards,** Altamont, N. Y.

Periplaneta australasiae Fabr., Australian cockroach, nymph, June 7, **Tilden Palmatier,** Athens, N. Y.

### Thysanura

Thermobia furnorum Prov., fish moth, adult in woolen cloth, July 11, **C. E. Eldredge,** Leon, N. Y.

### Miscellaneous

A considerable number of insects of different orders were determined for Mr Charles Alexander of Gloversville, N. Y., and some of the more desirable ones retained for the State collection. They are as follows:

Carabus serratus *Say*
Bembidium ustulatum *Linn.*
Agabus seriatus *Say*
Necrophorus americanus *Oliv.*
Choleva terminans *Lec.*
Philonthus umbrinus *Grav.*
Lathrobium punctulatum *Lec.*
Tachinus memnonius *Grav.*
Tachinus luridus *Er.*
Dermestes frischii *Kug.*
Alaus myops *Fab.*
Anthaxia aeneogaster *Lap.*
Calloides nobilis *Say*
Tylonotus bimaculatus *Hald.*
Stephanocleonus plumbeus *Lec.*
Atymna castanea *Fitch*
Neuronia pardalis *Walk.*

## EXCHANGE

From **E. S. Tucker,** Lawrence, Kan., in exchange for publications:

Ophion idoneum Vier., Bracon xanthostigma Cr., Melanobracon ulmicola Vier., Agathis vulgaris Cr., Calyptus rotundiceps Cr., Aphaereta dolosa Vier., Nemigonia limosa Wheel., Lasius niger Linn., var. americanus Emery, Pelecinus polyturator Dru., Pompilus relatinus Fox, Isodontia azteca Sauss., Tachytes spatulatus Fox, T. obscurus Cr., Sphecius speciosus Dru., Euspongus bipunctatus Say, Mellinus rufinodus Cr., Mimesa punctata Fox, Stigmus inordinatus Fox, Epeolus occidentalis Cr., Clisodon terminalis Cr.

Staphylinus maculosus Grav., Romaleum atomarium Dru., Myochrous denticollis Say, Tomicus grandicollis Eich.

Catocala junetina Walk., var. aspasia Strk.

Ceratopogon squamipes Coq., Scatopse notata Loew., Allognosta fuscitarsis Say, Tabanus sulcifrons Macq., Xylomyia pallipes Loew., Deromyia ternata Loew., Erax stamineus Will., Psilopodinus sipho Say, Dolichopus bifractus Loew., D. cuprinus Wied., D. longipennis Loew., Empis clausa Coq., Rhamphomyia nasoni Coq., Eupeodes volucris O. S., Allograpta obliqua Say, Oncomyia loraria Loew., Myiophasia aenea Wied., Siphopla-

gia anomala Town., Blepharipeza leucophrys Wied., Paradidyma singularis Town., Myiocera cremides Wlk., Sarcophaga helicis Town., Morellia micans Macq., Limnophora narona Walk., Phorbia cinerella Fall., Coenosia lata Walk., Schoenomyza dorsalis Loew., Scatophaga furcata Say, Borborus equinus Fall., Lonchaea polita Say, Pachycerina dolorosa Will., Pseudotephritis cribrum Loew., Straussia longipennis Wied., Urellia actinobola Loew., Calobata antennipes Say, Nemopoda minuta Wied., Elachiptera costata Loew., Oscinis coxendix Fitch, Drosophila graminum Fall., Phormia regina Meig.

Corimelaena nitiduloides Wolff., Melanaethus uhleri Sign., Oebalus pugnax Fabr., Menecles insertus Say, Catorhintha mendica Stal., Anasa armigera Say, Hadrodema pulverulenta Uhl., Tygus distantii St F., Nabis rufusculus Reut., Sinea raptoria Stal., Agallia 4-punctata Prov., Deltocephalus melsheimeri Fabr., Dicraneura abnormis Walsh., Oncometopia costalis Fabr., Orthotylus flavosparsus Dhlb.

Hemerobius stigmaterus Fitch, Chrysopa nigricornis Burm., C. florabunda Fitch, Hydropsyche kansensis Bks., H. phalerata Hag., H. scalaris Hag.

Stylopyga orientalis Linn.

Sympetrum corruptum Hag.

Chrysididae from **A. Mocsary**, Budapest, Hungary:

Cleptes pallipes Lep., Notozus panzeri Fabr., Elampus auratus Linn., E. auratus var. virescens Mocs., E. bogdanovii Rad., E. aeneus Fabr., Holopyga amoenula Dhlb., H. amoenula var. punctatissima Dhlb., H. ahenea Dhlb., H. curvata Forst., H. gloriosa Fabr., H. chrysonota Forst., H. rosea Rossi, Hedychrum gerstaeckeri Cheve., H. nobile Scop., H. rutilans Dhlb., Stilbum cyanurum Forst. var. amethystinum F., Chrysogona pumila Rl., Spintharis vagans Rad., Chrysis austriaca Fabr., C. cuprea Rossi, C. dichroa Dhlb., C. elegans Lep., C. versicolor Spin., C. saussurei Cheve., C. succincta Linn., C. leachii Shuck., C. cyanea Linn., C. nitidula Fabr., C. viridula

Linn., C. ignita Linn., C. splendidula Rossi, C. rutilans Oliv., C. scutellaris F., C. scutellaris var. ariadne Mocs., C. inequalis Dhlb., C. comparata Lep., C. chloris Mocs., C. lyncea F. var. papuana Mocs., C. sexdentata Christ., C. (Euchroeus) purpuratus F., Tarnopes grandior Tall. (carnea Rossi).

Culicidae received in exchange for publications Jan. 30, 1906, from **Ebb. Crum,** Lawrence, Kan.:

Anopheles maculipennis Meig., Psorophora ciliata? Abr. young larva, Ecculex sylvestris Theo., Culex restuans Theo., C. territans Walk., C. ?tarsalis Coq., C. salinarius? Coq., Grabhamia discolor Coq., G. jamaicensis Theo., Culicada canadensis Theo.

Diptera from **Dr C. Kertesz,** Hungary, Jan. 11, 1906:

Tabanus tergestinus Egg., T. sudeticus Zell., T. spodopterus Meig., T. rusticus Fabr., T. quattuornotatus Meig., T. graecus F.?, T. fulvus Meig., T. tropicus Linn., T. bromius Linn., T. bovinus Linn., T. autumnalis Linn., T. auripilus Meig., var. aterrimus, T. africus Meig., Culex dorsalis Meig., C. vexans Meig., C. cantans Meig., C. ornatus Meig., C. pulcritarsis Rond., C. modestus Ficl., C. pipiens L., C. annulipes Meig., Aedes cinereus Meig., Anopheles maculipennis Meig.

Tachinidae from **Mario Bezzi,** Italy, Nov. 27, 1905:

Meigenia bisignata Meig., Dexodes machaeropsis R. D., Hemimasicera ferruginea Meig., Parexorista polychaeta, Blepharida vulgari Fall. var. stridens Bd., Perichaeta unicolor Fall., Mintho praeceps Scop., Melanota volvulus Fabr., Anthracomyia melanoptera Fall., Macquartia chalconota Meig., M. dispar Fall., Thelaira leucozona Panz., Zophomyia temula Scop., Myobia inanis Fall., Ocyptera bicolor Oliv., O. brassicaria Fabr., Bonellia picta Meig., Ernestia consobrina Meig., Echinomyia grossa Linn., Eudoromyia magnicornis Zett., Plagia ruralis Fall., Phasia crassipennis Fabr., Brachycoma devia Fall., Rhinophora atramentaria Meig., Metopia leucocephala Ross.,

Miltogramma oestracea Fall., Dexiosoma caninum Fabr.

Insects purchased from **Prof. F. H. Snow,** Lawrence, Kan.:

Psychoda alternata Say, Ceratopogon argentatus Lw., C. pergandei Coq., C. specularis Coq., Anopheles pseudopunctipennis Theo., Neoglaphyroptera bivittata Say, Cecidomyia radiatae Snow, Chrysops aestuans V. d. W., C. celer O. S., C. flavidus Wied., C. fugax O. S., C. indus O. S., C. striatus O. S., C. univittatus Macq., Tabanus costalis Wied., T. lasiophthalmus Macq., T. melanocerus Wied., T. molestus Say, T. nivosus O. S., T. pumilus Macq., T. stygius Say, T. trimaculatus P. B., T. venustus O. S., Eumetopia rufipes Macq., Stenopa vulnerata Lw., Plagiotoma obliqua Say, Carphotricha culta Wied., Neaspilota alba Lw., Tephritis clathrata Lw., Urellia solaris Lw.

Anelastes drurii Kir., Ischiodontus soleatus Say, Glyphonyx recticollis Say, Corymbites hieroglyphicus Say, Pyrophorus physoderus Germ., Euthysanius lautus Lec., Plastocerus schaumii Lec., Hylotrupes bajulus Linn., Sphaenothecus suturalis Lec., Coenopoeeus palmeri Lec., Leptostylus aculiferus Say, Mecas inornata Say, Macrorhoptus striatus Lec., Conotrachelus similis Boh., C. leucophaeatus Fah., Pityophthorus nitidulus Mann., Dendroctonus similis Lec., Hylastes nigrinus Mann., Lasioderma testaceum Duft., Hemiptychus gravis Lec., Sinoxylon simplex Horn., S. sericans Lec., S. sextuberculatum Lec., Amphicerus fortis Lec., A. punctipennis Lec., Polycaon obliquus Lec., Lyctus californicus Cr.

## EXCHANGE LIST

A number of desirable forms have been added to the State collection by exchange with others interested in this branch of science. A preliminary exchange list was published in the report of this office for 1903. There have been extensive additions to our collection since then, particularly in some groups, and it is therefore deemed desirable to prepare a revised list, which follows:

## Hymenoptera

Bombus fervidus *Fabr.*
B. ternarius *Say*
B. terricola *Kir.*
B. vagans *Sm.*
Xylocopa virginica *Dru.*
Ceratina dupla *Say*
Megachile latimanus *Say*
Nomada maculata *Cress.*
Andrena vicina *Sm.*
A. sayi *Rob.*
A. flavocylpeata *Sm.*
Agapostemon nigricornis *Fabr.*
Halictus parallelus *Say*
H. pilosus *Sm.*
Colletes inequalis *Say*
Vespa arenaria *Fabr.*
V. diabolica *Sauss.*
V. maculata *Linn.*
Polistes pallipes *St Farg.*
Odynerus capra *Sauss.*
Eumenes fraternus *Say*
Anacrabro ocellatus *Pack.*
Crabro singularis *Sm.*
C. trifasciatus *Say*
Pemphredon concolor *Say*
Philanthus solivagus *Say*
Hoplisus phaleratus *Say*
Monedula ventralis *Say*
Bembex fasciata *Fabr.*
Chalybion caeruleum *Linn.*
Pelopoeus cementarius *Dru.*
Ammophila communis *Cress.*
?Aporus biguttatus *Fabr.*
A. marginatus *Say*
Camponotus pennsylvanicus *Cress.*
Pelecinus polyturator *Dru.*
Calyptus crassigaster *Prov.*
Calyptus magdali *Cress.*
Macrocentrus solidaginis *Cress.*
Apanteles congregatus *Say*
Lampronota americana *Cress.*
Pimpla conquisitor *Say*
P. pedalis *Cress.*
P. inquisitor *Say*
Theronia fulvescens *Cress.*
Ephialtes irritator *Fabr.*
Thalessa lunator *Fabr.*
T. atrata *Fabr.*
Arotes decorus *Say*
Paniscus geminatus *Say*
Heteropelma flavicornis *Brullé*
Anomalon exile *Prov.*
Ichneumon centrator *Say*
I. duplicatus *Say*
I. laetus *Brullé*
I. scelestus *Cress.*
I. unifasciatorius *Say*
Foenus incertus *Cress.*
Andricus punctatus *Bass.*
Tremex columba *Linn.*
Strongylogaster rufocinctus *Nort.*
Macrophya flavicoxae *Nort.*
Allantus basilaris *Say*
Dolerus albifrons *Nort.*
D. apricus *Nort.*
D. aprilis *Nort.*
D. arvensis *Nort.*
D. similis *Nort.*
Harpiphorus varianus *Nort.*
Lygaeonematus erichsonii *Hartig.*
Hylotoma mcleayi *Leach*
Trichiocampus viminalis *Fall.*
Cimbex americana *Leach*

## Coleoptera

Cratoparis lunatus *Fabr.*
Hylesinus aculeatus *Say*
H. opaculus *Lec.*
Polygraphus rufipennis *Kir.*
Chramesus hicoriae *Lec.*
Scolytus rugulosus *Ratz.*
Tomicus calligraphus *Germ.*
T. grandicollis *Eich.*
Tomicus pini *Say*
T. balsameus *Lec.*
T. integer *Eich.*
Dryocoetes eichhoffei *Hopk.*
Xyleborus celsus *Eich.*
X. dispar *Fabr.*
Pityophthorus minutissimus *Zimm.*
Stenocelis brevis *Boh.*

Cossonus platalea *Say*
Calandra granaria *Linn.*
C. oryzae *Linn.*
Sphenophorus sculptilis *Uhler.*
Balaninus uniformis *Lec.*
B. nasicus *Say*
Centrinus scutellum-album *Say*
Madarellus undulatus *Say*
Pseudobaris nigrina *Say*
Rhinoncus pyrrhopus *Lec.*
Coeliodes aspicalis *Dietz*
Mononychus vulpeculus *Fabr.*
Cryptorhynchus lapathi *Linn.*
Tyloderma foveolatum *Say*
Conotrachelus nenuphar *Hbst.*
Gymnetron teter *Fab.*
Elleschus ephippiatus *Say*
Anthonomus signatus *Say*
Tachypterus quadrigibbus *Say*
Magdalis perforata *Horn*
M. barbita *Say*
M. armicollis *Say*
M. alutacea *Lec.*
Tanysphyrus lemnae *Fabr.*
Dorytomus parvicollis *Casey*
Lixus concavus *Say*
Hylobius pales *Hbst.*
Pissodes strobi *Peck*
Phytonomus punctatus *Fabr.*
P. nigrirostris *Fabr.*
Apion nigrum *Hbst.*
Sitones hispidulus *Germ.*
Cyphomimus dorsalis *Horn*
Aphrastus taeniatus *Gyll.*
Pandeletejus hilaris *Hbst.*
Otiorhynchus ovatus *Linn.*
Rhynchites bicolor *Fab.*
Pomphopoea sayi *Lec.*
Epicauta puncticollis *Mann.*
E. vittata *Fabr.*
E. cinerea *Forst.*
E. pennsylvanica *DeG.*
Macrobasis unicolor *Kir.*
Henous confertus *Say*
Meloe angusticollis *Say*
Dendroides canadensis *Lat.*
Notoxus bifasciatus *Lec.*
N. anchora *Hentz.*
Corphyra lugubris *Say*
Mordellistena comata *Lec.*
Mordellistena aspersa *Melsh.*
M. convicta *Lec.*
Mordella melaena *Germ.*
M. scutellaris *Fabr.*
M. octopunctata *Fabr.*
M. marginata *Melsh.*
Tomoxia lineella *Lec.*
Anaspis flavipennis *Hald.*
A. rufa *Say*
Nacerdes melanura *Linn.*
Pytho americanus *Kir.*
Phloeotrya simulator *Newm.*
Melandrya striata *Say*
Penthe obliquata *Fabr.*
Arthromacra aenea *Say*
Cistela sericea *Say*
Boletotherus bifurcus *Fabr.*
Platydema ruficorne *Sturm.*
P. subcostatum *Lap.*
Hoplocephala bicornis *Oliv.*
Diaperis hydni *Fabr.*
Paratenetus punctatus *Sol.*
Dioedus punctatus *Lec.*
Tribolium ferrugineum *Fabr.*
Tenebrio obscurus *Fabr.*
T. molitor *Linn.*
T. castaneus *Knoch.*
T. tenebrioides *Beauv.*
Xylopinus saperdioides *Oliv.*
Scotobates calcaratus *Fabr.*
Upis ceramboides *Linn.*
Merinus laevis *Oliv.*
Iphthimus opacus *Lec.*
Nyctobates pennsylvanica *DeG.*
Eleodes tricostata *Say*
Bruchus pisi *Linn.*
B. obsoletus *Say*
Chelymorpha argus *Licht.*
Coptocycla aurichalcea *Fabr.*
Odontota quadrata *Fabr.*
Microrhopala vittata *Fabr.*
Dibolia borealis *Chev.*
Phyllotreta sinuata *Steph.*
Systena hudsonias *Forst.*
S. frontalis *Fabr.*
S. taeniata *Say*
Crepidodera rufipes *Linn.*
C. helxines *Linn.*
Epitrix cucumeris *Harr.*
Haltica bimarginata *Say*

Disonycha pennsylvanica *Ill.*
D. collaris *Fabr.*
D. alternata *Ill.*
Galerucella cavicollis *Lec.*
G. decora *Say*
G. luteola *Muls.*
Trirhabda canadensis *Kir.*
Diabrotica duodecim-punctata *Oliv.*
D. vittata *Fabr.*
Cerotoma caminea *Fabr.*
Phyllodecta vulgatissima *Linn.*
Melasoma tremulae *Fabr.*
M. scripta *Fabr.*
Chrysomela similis *Rog.*
C. elegans *Oliv.*
C. bigsbyana *Kir.*
C. spiraeae *Say*
Doryphora clivicollis *Kir.*
D. decim-lineata *Say*
Prasocuris vittata *Oliv.*
Nodonota tristis *Oliv.*
Colaspis brunnea *Fabr.*
Graphops pubescens *Melsh.*
Metachroma marginalis *Cress.*
Typophorus canellus *Fabr.*
Chrysochus auratus *Fabr.*
Glyptoscelis hirtus *Oliv.*
G. pubescens *Melsh.*
Fidia viticida *Walsh*
Xanthonia decim-notata *Say*
Monachus saponatus *Fabr.*
Cryptocephalus quadri-maculatus *Say*
Chlamys plicata *Fabr.*
Crioceris asparagi *Linn.*
C. duodecim-punctata *Linn.*
Lema trilineata *Oliv.*
Syneta ferruginea *Germ.*
Orsodachna atra *Ahr.*
Donacia cincticornis *Newm.*
D. piscatrix *Lac.*
D. rufa *Say*
Tetraopes tetraophthalmus *Forst.*
Saperda tridentata *Oliv.*
S. puncticollis *Say*
Hyperplatys maculatus *Hald.*
Liopus alpha *Say*
Monohammus maculosus *Hald.*
M. scutellatus *Say*
M. confusor *Kir.*
Leptura haematites *Newm.*
L. lineola *Say*
L. exigua *Newm.*
L. cordifera *Oliv.*
L. canadensis *Oliv.*
L. vagans *Oliv.*
L. proxima *Say*
L. vittata *Germ.*
L. pubera *Say*
Strangalia acuminata *Oliv.*
Typocerus velutinus *Oliv.*
Rhagium lineatum *Oliv.*
Desmocerus palliatus *Forst.*
Euderces picipes *Fabr.*
Clytanthus ruricola *Oliv.*
Neoclytus erythrocephalus *Fabr.*
Xylotrechus colonus *Fabr.*
Plagionotus speciosus *Say.*
Cyllene robiniae *Forst.*
Molorchus bimaculatus *Say*
Elaphidion villosum *Fabr.*
Callidium antennatum *Newm.*
Prionus laticollis *Dru.*
Orthosoma brunneum *Forst.*
Parandra brunnea *Fabr.*
Trichius affinis *Gory*
Osmoderma scabra *Beauv.*
O. eremicola *Knoch.*
Euphoria inda *Linn.*
Allorhina nitida *Linn.*
Chalepus trachypygus *Burm.*
Pelidnota punctata *Linn.*
Strigoderma arboricola *Fabr.*
Anomala lucicola *Fabr.*
Lachnosterna fusca *Froh.*
L. tristis *Fabr.*
Macrodactylus subspinosus *Fabr.*
Serica trociformis *Burm.*
Dichelonycha elongata *Fabr.*
D. albicollis *Burm.*
Hoplia trifasciata *Say*
H. modesta *Hald.*
Geotrupes semiopacus *Jek.*
G. egeriei *Germ.*
Bolboceras farctus *Fabr.*
Aphodius fossor *Linn.*
A. fimetarius *Linn.*
A. granarius *Linn.*
A. inquinatus *Hbst.*

Onthophagus pennsylvanicus *Hald.*
O. hecate *Panz.*
Phanaeus carnifex *Linn.*
Copris anaglypticus *Say*
Canthon laevis *Dru.*
Passalus cornutus *Fabr.*
Ceruchus piceus *Web.*
Dorcus parallelus *Say*
Ennearthron thoracicornis *Ziegl.*
Cis horridula *Casey*
Dorcatoma setulosum *Lec.*
Sitodrepa panicea *Linn.*
Ernobius mollis *Linn.*
Ptinus quadrimaculatus *Melsh.*
Necrobia violaceus *Linn.*
Clerus analis *Lec.*
C. quadriguttatus *Oliv.*
C. nigriventris *Lec.*
Trichodes nuttalli *Kir.*
Telephorus carolinus *Fabr.*
T. scitulus *Say*
T. rotundicollis *Say*
T. bilineatus *Say*
Podabrus rugulosus *Lec.*
Chauliognathus pennsylvanicus *DeG.*
C. marginatus *Fabr.*
Photuris pennsylvanicus *DeG.*
Photinus scintillans *Say*
Pyropyga nigricans *Say*
Ellychnia corrusca *Linn.*
Lucidota atra *Fabr.*
Plateros sollicitus *Lec.*
Calopteron reticulatum *Fabr.*
Brachys ovata *Web.*
B. aerosa *Melsh.*
Agrilus ruficollis *Fabr.*
A. otiosus *Say*
A. anxius *Gory*
Acmaeodera pulchella *Hbst.*
Buprestis maculiventris *Say*
Chrysobothris femorata *Fabr.*
C. dentipes *Germ.*
C. floricola *Gory*
C. scabripennis *Lap. & Gory*
C. pusilla *Lap. & Gory*
Melanophila fulvoguttata *Harr.*
Dicerca divaricata *Say*
D. lurida *Fabr.*
Chalcophora virginiensis *Dru.*
Asaphes decoloratus *Say*
Oxygonus obesus *Say*
Corymbites cylindriformis *Hbst.*
C. inflatus *Say*
Limonius confusus *Lec.*
Melanotus communis *Gyll.*
Dolopius lateralis *Esch.*
Elater nigricollis *Hbst.*
E. obliquus *Say*
Cryptohypnus planatus *Lec.*
Cardiophorus convexus *Say*
Alaus oculatus *Linn.*
Tharops ruficornis *Say*
Cyphon variabilis *Thunb.*
Scirtes tibialis *Guer.*
Tenebrioides mauritanica *Linn.*
T. corticalis *Melsh.*
Ips quadriguttatus *Fabr.*
Phenolia grossa *Fabr.*
Nitidula bipustulata *Linn.*
Conotelus obscurus *Er.*
Colastus truncatus *Rand.*
Carpophilus dimidiatus *Fabr.*
C. brachypterus *Say*
Saprinus assimilis *Payk.*
Hister abbreviatus *Fabr.*
H. americanus *Payk.*
H. lecontei *Mars.*
H. parallelus *Say*
Anthrenus scrophulariae *Linn.*
A. verbasci *Linn.*
A. castaneae *Melsh.*
Attagenus piceus *Oliv.*
Dermestes lardarius *Linn.*
Byturus unicolor *Say*
Triphyllus humeralis *Kir.*
Mycetophagus punctatus *Say*
M. flexuosus *Say*
Lyctus unipunctatus *Hbst.*
L. parallelopipedus *Melsh.*
L. opaculus *Lec.*
Uliota dubius *Fabr.*
Laemophloeus testaceus *Fabr.*
Cucujus clavipes *Fabr.*
Catogenus rufus *Fabr.*
Silvanus surinamensis *Linn.*
Tritoma humeralis *Fabr.*
T. thoracica *Say*
Megalodacne heros *Say*

Languria mozardi *Lat.*
Endomychus biguttatus *Say*
Lycoperdina ferruginea *Lec.*
Epilachna borealis *Fabr.*
Hyperaspis binotata *Say*
Brachyacantha ursina *Fabr.*
Smilia misella *Lec.*
Chilocorus bivulnerus *Muls.*
Psyllobora viginti-maculata *Say*
Anatis ocellata *Linn.*
Adalia bipunctata *Linn.*
Coccinella trifasciata *Linn.*
C. novem-notata *Hbst.*
C. transversalis *Muls.*
C. sanguinea *Linn.*
Hippodamia glacialis *Fabr.*
H. convergens *Guer.*
H. tredecim-punctata *Linn.*
H. parenthesis *Say*
Megilla maculata *DeG.*
Oxytelus rugosus *Grav.*
Oxyporus femoralis *Grav.*
O. lateralis *Grav.*
Erchomus ventriculus *Say*
Tachinus fimbriatus *Grav.*
Paederus littorarius *Grav.*
Stenus flavicornis *Er.*
Philonthus aeneus *Rossi*
Staphylinus maculosus *Grav.*
S. cinnamopterus *Grav.*
Creophilus villosus *Grav.*
Listotrophus cingulatus *Grav.*
Silpha surinamensis *Fabr.*
S. lapponica *Hbst.*
S. inaequalis *Fabr.*
S. noveboracensis *Forst.*
S. americana *Linn.*
Necrophorus marginatus *Fabr.*
N. pustulatus *Hersch.*
N. tomentosus *Web.*
Sphaeridium scarabaeoides *Linn.*
Cercyon praetextatum *Say*
Hydrobius fuscipes *Linn.*
Hydrocharis obtusatus *Say*
Hydrophilus triangularis *Say*
H. mixtus *Lec.*
H. glaber *Hbst.*
Dineutes discolor *Aubé*
D. assimilis *Aubé*
Gyrinus ventralis *Kirby*
G. picipes *Aubé*
Acilius semisulcatus *Aubé*
Dytiscus fasciventris *Say*
D. harrisii *Kirby*
Colymbetes sculptilis *Harr.*
Agabus gagates *Aubé*
A. punctulatus *Aubé*
Ilybius bigguttalus *Germ.*
Hydroporus tristis *Payk.*
Deronectes griseostriatus *DeG.*
Laccophilus maculosus *Germ.*
Cnemidotus duodecim-punctatus *Say*
Haliplus ruficollis *DeG.*
Anisodactylus rusticus *Say*
A. discoideus *Dej.*
A. baltimorensis *Say*
Bradycellus rupestris *Say*
Harpalus erraticus *Say*
H. viridiaeneus *Beauv.*
H. caliginosus *Fabr.*
H pennsylvanicus *DeG.*
H. fallax *Lec.*
H. pleuriticus *Kirby*
H. herbivagus *Say*
Agonoderus pallipes *Fabr.*
Chlaenius sericeus *Forst.*
C. tricolor *Dej.*
C. pennsylvanicus *Say*
C. tomentosus *Say*
Metabletus americanus *Dej.*
Apristus cordicollis *Lec.*
Lebia grandis *Hentz.*
L. atriventris *Say*
L. viridis *Say*
Galerita janus *Fabr.*
Platynus angustatus *Dej.*
P. extensicollis *Say*
P. melanarius *Dej.*
Calathus gregarius *Say*
Dicaelus elongatus *Bon.*
Amara impuncticollis *Say*
Pterostichus honestus *Say*
P. stygicus *Say*
P. lucublandus *Say*
P. caudicalis *Say*
P. luctuosus *Dej.*
P. corvinus *Dej.*
P. mutus *Say*

Pterostichus patruelis *Dej.*
P. femoralis *Kirby*
Tachys nanus *Gyll.*
T. flavicauda *Say*
Bembidium variegatum *Say*
B. quadri-maculata *Linn.*
Scarites subterraneus *Fabr.*
Pasimachus elongatus *Lec.*
Nebria sahlbergi *Fisch.*
Elaphrus ruscarius *Say*
Calosoma calidum *Fabr.*
Carabus vinctus *Web.*
Omophron americanum *Dej.*
Cicindela lecontei *Hald.*
C. sexguttata *Fabr.*
C. generosa *Dej.*
C. vulgaris *Say*
C. repanda *Dej.*
C. purpurea *Oliv.*
C. duodecim-guttata *Dej.*
C. punctulata *Fabr.*

**Diptera**

Drosophila ampelophila *Loew.*
Chlorops prolifica *O. S.*
Ephydra atrovirens *Loew.*
Piophila casei *Linn.*
Tephritis platyptêra *Loew.*
Rhagoletis cingulata *Loew.*
Seoptera colon *Loew.*
Melierial similis *Loew.*
Lauxania flaviceps *Loew.*
Straussia longipennis *Wied.*
Sepedon fuscipennis *Loew.*
Tetanocera plebeja *Loew.*
Phorbia fusciceps *Zett.*
Pollenia rudis *Fabr.*
Calliphora erythrocephala *Meig.*
Sarcophaga sarraceniae *Riley*
Echinomyia algens *Wied.*
Archytas analis *Fabr.*
Peleteria tessellata *Fabr.*
Gonia capitata *DeG.*
Tachina mella *Walk.*
T. robusta *Town.*
Ocyptera carolinae *Desv.*
Belvosia unifasciata *Desv.*
Physocephala furcillata *Will.*
Spilomyia fusca *Loew.*
Xylota ejuncida *Say*
Syritta pipiens *Linn.*
Mallota posticata *Fabr.*
Helophilus similis *Macq.*
Eristalis dimidiatus *Wied.*
E. saxorum *Wied.*
E. tenax *Linn.*
E. transversus *Wied.*
Sericomyia chrysotoxoides *Macq.*
Volucella evecta *Walk.*
Rhingia nasica *Say*
Sphaerophoria cylindrica *Say*
Mesogramma marginata *Say*
Syrphus americanus *Wied.*
S. lesueurii *Macq.*
S. ribesii *Linn.*
S. torvus *O. S.*
Platychirus quadratus *Say*
Hydrophorus pirata *Loew*
Liancalus genualis *Loew*
Promachus bastardii *Macq.*
Deromyia umbrina *Loew*
Bombylius major *Linn.*
Anthrax sinuosa *Wied.*
A. alternata *Say*
A. concessor *Coq.*
A. fuliginosa *Loew.*
A. nebulo *Coq.*
Chrysopila thoracica *Fabr.*
Leptis mystacea *Macq.*
Tabanus coffeatus *Macq.*
T. lineola *Fabr.*
T. microcephalus *O. S.*
T. reinwardtii *Wied.*
Chrysops excitans *Walk.*
C. niger *Macq.*
C. vittatus *Wied.*
Pangonia tranquilla *O. S.*
Stratiomyia badia *Walk.*
S. discalis *Loew.*
Sargus decorus *Say*
Bibio albipennis *Say*
Rhabdophaga salicis *Schrank.*
Dasyneura pseudacaciae *Fitch*
Anopheles punctipennis *Say*
A. maculipennis *Meig.*
Psorophora ciliata *Fabr.*
Culicelsa aurifer *Coq.*

Culicada canadensis *Theo.*
C. subcantans *Felt*
C. fitchii *Felt & Young*
C. abfitchii *Felt*
C. cantator *Coq.*
C. sollicitans *Walk.*
C. impiger *Walk.*
C. lazarensis *Felt & Young*
C. cinereoborealis *Felt & Young*
C. abserratus *Felt & Young*
Ecculex sylvestris *Theo.*
Culicella dyari *Coq.*
Culex pipiens *Linn.*
C. restuans *Theo.*
C. territans *Walk.*
Aedes fuscus *O. S.*
Wyeomyia smithii *Coq.*
Corethra cinctipes *Coq.*
C. lintneri *Coq.*
C. karnerensis *Felt*
Tipula abdominalis *Say*

**Lepidoptera**

Papilio turnus *Linn.*
Pontia rapae *Linn.*
Eurymus philodice *Gdt.*
Argynnis aphrodite *Edw.*
A. atlantis *Edw.*
Brenthis myrina *Cram.*
B. bellona *Fabr.*
Phyciodes tharos *Drury*
Polygonia interrogationis *Fabr.*
P. faunus *Edw.*
Eugonia j-album *Bd. Lec.*
Euvanessa antiopa *Linn.*
Vanessa atalanta *Linn.*
Basilarchia arthemis *Drury*
B. archippus *Cram.*
Anosia plexippus *Linn.*
Feniseca tarquinius *Fabr.*
Heodes hypophleas *Boisd.*
Deilephila lineata *Fabr.*
Samia cecropia *Linn.*
Callosamia promethea *Drury*
Ctenucha virginica *Charp.*
Haploa confusa *Lyman*
Estigmene acraea *Drury*
Isia isabella *Sm. & Abb.*
Diacrisia virginica *Fabr.*
Apantesis virgo *Linn.*
A. parthenice *Kirby*
Halisidota tessellaris *Sm. & Abb.*
H. caryae *Harr.*
Alypia octomaculata *Fabr.*
Arsilonche albovenosa *Goeze*
Hadena passer *Guen.*
H. dubitans *Walk.*
H. devastatrix *Brace*
H. arctica *Boisd.*
Hyppa xylinoides *Guen.*
Pyrophila pyramidoides *Guen.*
Adelphagrotis prasina *Fab.*
Peridroma margaritosa *Haw.*
Noctua smithii *Snellen*
N. normaniana *Grote*
N. bicarnea *Guen.*
N. c-nigrum *Linn.*
N. plecta *Linn.*
N. clandestina *Harr.*
Feltia subgothica *Steph.*
F. jaculifera *Guen.*
Paragrotis redimicula *Mon.*
Mamestra purpurissata *Grote*
M. meditata *Grote*
M. picta *Harr.*
M. renigera *Steph.*
M. olivacea *Morr.*
Nephelodes minians *Guen.*
Heliophila unipunctata *Haw.*
H. luteopallens *Sm.*
Tricholita signata *Walk.*
Cucullia intermedia *Spey.*
Gortyna nictitans *Bork.*
Orthosia helva *Grote*
Trigonophora periculosa *Guen.*
Heliothis armiger *Hübn.*
Euthisanotia grata *Fabr.*
Plusia aerea *Hübn.*
P. aeriodes *Grote*
P. balluca *Geyer*
Autographa bimaculata *Steph.*
A. precationis *Guen.*
A. brassicae *Riley*
A. rectangula *Kirby*
A. u-aureum *Guen.*

Autographa falcigera *Kirby*
Drasteria erechtea *Cram.*
Eustrotia carneola *Guen.*
Catocala unijuga *Walk.*
Parallelia bistriaris *Hübn.*
Datana integerrima *Gr. & Rob.*
Notolophus badia *Hy. Edwards*
Malacosoma americana *Fabr.*
M. disstria *Hübn.*
Eudule mendica *Walk.*
Euchoeca albovittata *Guen.*
Eustroma diversilineata *Hübn.*
Orthofidonia vestaliata *Guen.*
Cingilia catenaria *Drury*
Xanthotype crocataria *Fabr.*
Sabulodes transversata *Drury*
Sesia tipuliformis *Clerck*
Desmia funeralis *Hübn.*
Evergestis straminalis *Hübn.*
Tholeria reversalis *Guen.*
Hypsopygia costalis *Fabr.*
Epagoge sulfureana *Clem.*
Archips rosaceana *Harr.*
A. rosana *Linn.*
A. parallela *Rob.*
A. argyrospila *Walk.*
Adela purpura *Walk.*
Acrobasis rubrifasciella *Pack.*

## Hemiptera

Homaemus aeneifrons *Say*
Eurygaster alternatus *Say*
Canthophorus cinctus *Beauv.*
Podisus placidus *Uhl.*
P. maculiventris *Say*
Brochymena quadripustulata *Fabr.*
Cosmopepla carnifex *Fabr.*
Mormidea lugens *Fabr.*
Euschistus servus *Say*
E. fissilis *Uhl.*
E. tristigmus *Say*
E. variolarius *Beauv.*
Coenus delius *Say*
Pentatoma juniperina *Linn.*
Murgantia histrionica *Hahn.*
Nezara hilaris *Say*
Anasa tristis *DeG.*
Corizus novaeboracensis *Sign.*
Alydus eurinus *Say*
Leptocoris trivittatus *Say*
Nysius augustatus *Uhl.*
Ischnorhynchus didymus *Zett.*
Cymus angustatus *Stal.*
Blissus leucopterus *Say*
Peliopelta abbreviata *Uhl.*
Lygaeus turcicus *Fabr.*
Ligyrocoris sylvestris *Linn.*
L. constrictus *Say*
Brachytropis calcarata *Fall.*
Miris affinis *Reut.*
Leptopterna dolobrata *Linn.*
Lopidea media *Say*
Lomatopleura caesar *Reut.*
Calocoris rapidus *Say*
Lygus pabulinus *Linn.*
L. pratensis *Linn.*
L. monachus *Uhl.*
Poeciloscytus basalis *Reut.*
Poecilocapsus lineatus *Fabr.*
P. goniphorus *Say*
Systratiotus venaticus *Uhl.*
Capsus ater *Linn.*
Pilophorus crassipes *Uhl.*
P. amoenus *Uhl.*
Stiphrosoma stygica *Say*
Plagiognathus obscurus *Uhl.*
P. fraternus *Uhl.*
Piesma cinerea *Say*
Corythuca arcuata *Say*
C. ciliata *Say*
C. juglandis *Fitch*
C. marmorata *Uhl.*
Gargaphia amorphae *Walsh*
Brachyrhynchus moestus *Stal.*
Phymata wolffii *Stal.*
Coriscus subcoleoptratus *Kirby*
C. inscriptus *Kirby*
Nabis rufusculus *Reut.*
Acholla multispinosa *DeG.*
Limnotrechus marginatus *Say*
Belostoma americanum *Leidy.*
Notonecta undulata *Say*
Corixa calva *Say*
C. abdominalis *Say*

Tibicen septendecim *Linn.*
T. tibicen *Linn.*
Entylia bactriana *Germ.*
Pubilia concava *Say*
Ceresa diceros *Say*
C. bubalus *Fabr.*
C. turbida *Godg.*
Stictocephala inermis *Fabr.*
Smilia camelus *Fabr.*
Telamona ampelopsidis *Harr.*
Enchenopa binotata *Say*
Campylenchia curvata *Fabr.*
Scolops sulcipes *Say*
Cixius stigmatus *Say*
Stenocranus dorsalis *Fitch*
Liburnia lateralis *V. D.*
L. lutulenta *V. D.*
Ormenis pruinosa *Say*
Lepyronia quadri-angularis *Say*
Aphrophora saratogensis *Fitch*
Philaenus lineatus *Linn.*
Clastoptera obtusa *Say*
C. proteus *Fitch*
Tettigonia gothica *Sign.*
Diedrocephala coccinea *Forst.*
Draeculacephala novaeboracensis *Fitch*
D. mollipes *Say*
Bythoscopus pruni *Prov.*
Idiocerus suturalis *Fitch*
I. lachrymalis *Fitch*
Agallia quadri-punctata *Prov.*
A. sanguinolenta *Prov.*
Platymetopius acutus *Say*
Platymetopius frontalis *V. D.*
Deltocephalus sayi *Fitch*
D. inimicus *Say*
D. melsheimeri *Fitch*
Athysanus curtisii *Fitch*
Phlepsius irroratus *Say*
Scaphoideus immixtus *Say*
Thamnotettix clitellaria *Say*
Chlorotettix unicolor *Fitch*
Cicadula slossoni *V. D.*
C. sep-notata *Fallen.*
Gnathodus punctatus *Thunb.*
Empoasca rosae *Harr.*
E. bifasciatus *G. & D.*
Typhlocyba comes *Harr.*
T. rosae *Linn.*
Psylla carpini *Fitch*
P. pyricola *Forst.*
P. rhois *Glov.*
P. annulata *Fitch*
Trioza tripunctata *Fitch*
Lachnus dentatus *L. B.*
Lepidosaphes ulmi *Linn.*
Aspidiotus perniciosus *Comst.*
A. ostreaeformis *Curt.*
A. ancylus *Putn.*
Aulacaspis rosae *Bouché*
Diaspis boisduvalii *Sign.*
Chionaspis furfura *Fitch*
C. euonymi *Comst.*
C. americana *Johns.*
Eulecanium nigrofasciatum *Perg.*
Pulvinaria innumerabilis *Rathv.*
Gossyparia spuria *Modeer.*

**Trichoptera**

Leptocerus resurgens *Walk.*
Hydropsyche scalaris *Hag.*
Halesus guttifer *Walk.*
Goniotaulius dispectus *Walk.*
Neuronia postica *Walk.*

**Mecoptera**

Panorpa rufescens *Rambus*
P. maculosa *Hag.*
Panorpa signifer *Banks.*
Bittacus strigosus *Hag.*

**Neuroptera**

Polystoechotes punctatus *Fabr.*
Corydalis cornuta *Linn.*
Chrysopa oculata *Say*
Sialis infumata *Newm.*

### Orthoptera

Melanopus femur-rubrum *DeG.*
M. femoratus *Scudd.*
M. atlanis *Riley*
Phylloptera oblongifolia *DeG.*
Diapheromera femorata *Say*
Camnula pellucida *Scudd.*
Dissosteira carolina *Linn.*
Circotettix verruculatus *Kirby*
Oecanthus pini *Beut.*
O. niveus *DeG.*
O. nigricornis *Walk.*

# Appendix

## NEW SPECIES OF CECIDOMYIIDAE

It has been considered advisable to publish the following preliminary descriptions in advance of an extended monograph on this group now in preparation. The generic references are strictly provisional and may need revision after further study.

### Campylomyza sylvestris n. sp.

**Female.** Length 1 mm. Antennae extending to the base of the abdomen, sparsely haired, yellowish, 11 segments. Mesonotum reddish brown; scutellum lighter, postscutellum dark brown. Abdomen dull yellowish with the basal segments reddish, the distal ones dark brown. Legs fuscous yellowish.

Taken at Davidson's River, N.C. September 23, 1906.

Type Cecid. a1620, N.Y. State Museum.

### Campylomyza brevicornis n. sp.

**Female.** Length 2 mm. Antennae ¼ the length of the body, thickly haired, reddish brown, 11 segments. Mesonotum dark brown; scutellum and postscutellum dark reddish brown; abdomen reddish brown; membrane and pleurae dark salmon; ovipositor dark brown. Legs dark reddish brown; tarsi lighter, distal segments dark brown.

Taken at Nassau, N.Y. August 10, 1906.

Type Cecid. 756, N.Y. State Museum.

### Campylomyza flavoscuta n. sp.

**Male.** Length 1 mm. Antennae about as long as the body, sparsely haired, light brown, probably 11 segments. Mesonotum yellowish brown, scutellum reddish brown, postscutellum yellowish. Abdomen pale reddish brown. Legs a nearly uniform pale fuscous yellowish.

Taken at Albany, N.Y. June 4, 1906.

Type Cecid. 117, N.Y. State Museum.

### Campylomyza toxicodendri n. sp.

**Female.** Length 2 mm. Antennae hardly extending to the base of the abdomen, thickly clothed with whitish hairs, dark brown, 12 segments. Mesonotum dark brown with posterior median area yellowish brown. Scutellum and postscutellum pale reddish yellow, the former with sparse yellowish hairs. Abdomen pale fuscous yellowish. Terminal segments and ovipositor dark brown or black. Legs a nearly uniform pale straw-yellow.

Taken at Albany, N.Y. June 4, 1906, on poison ivy.

Type Cecid. 122, N.Y. State Museum.

### Campylomyza leguminicola n. sp.

**Male.** Length .75 mm. Antennae extending to the base of the 2d abdominal segment, sparsely haired, reddish brown, 14 segments. Mesonotum dark brown; scutellum and postscutellum reddish brown; abdomen dark brown or black. Femora and tibiae brownish straw color, lighter ventrally, tarsi a pale straw color, terminal segments darker.

Taken at Albany, N.Y. June 4, 1906, on red clover.

Type Cecid. 121, N.Y. State Museum.

### Campylomyza vitinea n. sp.

**Male.** Length .75 mm. Antennae shorter than the body, sparsely clothed with long hairs, brown, 13 segments. Mesonotum dark brown; scutellum and abdomen brown; genitalia darker. Femora and tibiae pale, tarsi darker.

Taken at Albany, N.Y. August 14, 1906, about grape or ash.

Type Cecid. 759, N. Y. State Museum.

### Campylomyza graminea n. sp.

**Male.** Length 1.5 mm. Antennae about $\frac{2}{3}$ the length of the body, sparsely haired, dark brown, 14 segments. Head and thorax black or dark brown, abdomen dark brown; pleurae and incisures yellowish brown. Legs yellowish transparent or reddish.

Taken on grass at Karner, N.Y. April 27, 1906.

Type Cecid. 5, N.Y. State Museum.

### Campylomyza populi n. sp.

**Male.** Length 1 mm. Antennae extending to the basal abdominal segments, sparsely haired, dark brown, 14 segments. Meso-

notum dark brown; scutellum and postscutellum a little lighter. Abdomen dark brown, very sparsely clothed with fine yellowish hairs. Legs nearly uniform, light slaty brown.

Taken at Albany, N.Y. June 4, 1906, on the large leafed poplar.

Type Cecid. 115, N.Y. State Museum.

### Campylomyza balsamicola n. sp.

**Male.** Length .75 mm. Antennae nearly as long as the body sparsely haired, dark brown, 14 segments. The entire body a nearly uniform dark brown. Legs a nearly uniform straw-brown.

Taken on balsam at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 145, N.Y. State Museum.

### Campylomyza pomiflorae n. sp.

**Male.** Length .75 mm. Antennae nearly as long as the body, rather thickly haired, dark brown, 14 segments. Head, thorax and abdomen dark brown. Legs brownish yellow; tarsi light yellow; tip of posterior tibiae, anterior tarsi and the terminal segments of the middle and posterior tarsi variably tinged with reddish.

Taken at Karner, N.Y. May 4, 1906, flying about shad bush and cherry bloom.

Type Cecid. 11, 12, 13 and 15, N.Y. State Museum.

### Campylomyza photophila n. sp.

**Male.** Length .5 mm. Antennae nearly as long as the body, thickly haired, dark brown, 14 segments. Thorax dark reddish; abdomen dark brown, somewhat fuscous posteriorly. Legs fuscous yellowish, distal tarsal segments reddish brown.

Taken at Albany, N.Y. August 8, 1906; also at Poughkeepsie.

Type Cecid. 747, 748 and 753, N.Y. State Museum.

### Campylomyza modesta n. sp.

**Male.** Length .4 mm. Antennae probably twice as long as the body, sparsely haired, light brown, probably 14 segments. Entire body a nearly uniform dark brown. Legs a nearly uniform yellowish straw; tarsi tinged with carmine.

Taken on balsam at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 147, N.Y. State Museum.

### Campylomyza gibbosa n. sp.

**Male.** Length 1 mm. Antennae longer than the body, sparsely haired, dark brown, probably 14 segments. Head, thorax and abdomen dark brown; legs pale straw color, irregularly tinged with carmine, especially near the articulations.

Taken on spruce at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 162, N.Y. State Museum.

### Campylomyza carolinae n. sp.

**Male.** Length .4 mm. Antennae twice the length of the body, light brown, 14 segments. Mesonotum reddish brown; scutellum, postscutellum and basal abdominal segments dark reddish brown, the distal abdominal segments dull black. Legs nearly uniform fuscous yellowish.

**Female.** Length .5 mm. Antennae a little longer than the body, light brown, 11 segments; otherwise as in the male.

Taken at Davidson's River, N.C. September 23, 1906.

Type Cecid. a1619, N.Y. State Museum.

### Campylomyza carpini n. sp.

**Male.** Length 1 mm. Antennae nearly as long as the body, thickly haired, dark brown, 15 segments. Mesonotum black; scutellum and abdomen dark brown. Legs pale, grayish, tarsi variably tinged with reddish.

Taken at Albany, N.Y. June 1, 1906, on ironwood.

Type Cecid. 107, N.Y. State Museum.

### Campylomyza lignivora n. sp.

**Male.** Length 1.3 mm. Antennae extending to the 4th abdominal segment, sparsely clothed with long hairs, light brown, 16 segments. Abdomen dark red, the dorsal sclerites slightly ferruginous, sparsely clothed with short setae. Legs a nearly uniform fuscous yellowish; femora and tibiae hairy.

**Female.** Length 2.5 mm. Antennae extending to the base of the abdomen, densely yellowish haired, yellowish brown, 21 segments. Other color characters practically as in the male.

Found at Davidson's River, N.C. September 21, 1906, breeding in the fungus-affected heart of a hard pine.

Type Cecid. a1614, N.Y. State Museum.

### Campylomyza cerasi n. sp.

**Female.** Length .75 mm. Antennae as long as the body, sparsely haired, dark brown, annulate with lighter, 14 segments. Head, thorax and abdomen dark brown; legs light brown with indistinct reddish markings at the articulations between the coxae and femora; the latter and tibiae; on the apex of the tibiae; and with more or less suffused reddish tints on the tarsi.

Taken at Nassau, N.Y. May 15, 1906, sweeping in the vicinity of wild cherry.

pe Cecid. 18, N.Y. State Museum.

### Campylomyza tsugae n. sp.

**Female.** Length 1 mm. Antennae extending to the base of the abdomen, thickly clothed with fine hairs, dark brown, 13 segments. Mesonotum dark brown; scutellum yellowish brown. Abdomen dark brown. Legs a nearly uniform dark straw, terminal segment slightly darker.

Taken at Lake Clear, N.Y. June 7, 1906, on hemlock.

Type Cecid. 166, N.Y. State Museum.

### Campylomyza karnerensis n. sp.

**Male.** Length 1.5 mm. Antennae probably nearly as long as the body, sparsely haired, dark brown, probably 14 segments. Mesonotum dark brown; abdomen reddish brown. Legs semitransparent with irregular reddish bands on the tarsi and at the tip of the tibiae, particularly on the posterior legs.

Taken at Karner, N.Y. May 16, 1906.

Type Cecid. 29, N.Y. State Museum.

### Campylomyza acerifolia n. sp.

**Male.** Length .4 mm. Antennae longer than the body, sparsely haired, dark brown, 16 segments. Mesonotum dark brown; scutellum yellowish brown, postscutellum darker. Abdomen light brown; legs mostly dark brown.

Taken at Albany, N.Y. May 21, 1906, on soft maple.

Type Cecid. 71, N.Y. State Museum.

### Catocha sambuci n. sp.

**Female.** Length 1.5 mm. Antennae $\frac{1}{3}$ the length of the body, sparsely haired, dark brown, fuscous yellowish basally, 11 segments.

Mesonotum reddish brown; scutellum and postscutellum fuscous reddish yellow. Abdomen fuscous yellow, membrane and pleurae lighter. Ovipositor slightly fuscous. Legs dark fuscous yellowish.

Taken at Albany, N.Y. August 6, 1906, on elder.

Type Cecid. 743, N.Y. State Museum.

### **Catocha sylvestris** n. sp.

**Female.** Length 3 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, basally pale yellowish, 11 segments. Mesonotum dark brown, the median posterior area dark yellowish. Scutellum pale yellowish orange. Postscutellum dark brown; abdomen yellowish brown; incisures and pleurae pale salmon; terminal segment pale yellowish; coxae pale yellowish, femora semitransparent, tibiae and tarsi fuscous yellowish.

Taken at Davidson's River, N.C. September 23, 1906.

Type Cecid. a1642, N.Y. State Museum.

### **Catocha spiraeina** n. sp.

**Male.** Length 1.5 mm. Antennae about as long as the body, rather thickly clothed with fine hairs, dark brown, yellowish basally, 16 segments. Mesonotum darker brown; scutellum reddish brown, slightly fuscous apically and with sparse apical setae. Postscutellum reddish brown. Abdomen dark brown, rather thickly clothed with fine setae. Genitalia fuscous yellowish. Legs a nearly uniform yellow straw color; articulations tinged with carmine, tarsi slightly darker.

Taken at Albany, N.Y. June 15, 1906, on spirea.

Type Cecid. 274, N.Y. State Museum.

### **Catocha solidaginis** n. sp.

**Male.** Length .75 mm. Antennae nearly as long as the body, thickly haired, dark brown, 16 segments. Mesonotum dark brown; scutellum dark carmine, postscutellum a little lighter. Abdomen fuscous yellowish, distal segment somewhat darker. Legs mostly pale fuscous yellowish, tarsi dark brown.

Taken on Solidago at Newport, N.Y. July 25, 1906.

Type Cecid. 700, N.Y. State Museum.

### **Micromyia corni** n. sp.

**Male.** Length 1.5 mm. Antennae very short, not extending to the base of the abdomen, sparsely haired, dark brown, 9 segments.

Mesonotum dark brown, submedian lines ornamented with pale yellowish setae. Scutellum and postscutellum dark brown. Abdomen dark brown with a distinct reddish tint distally and nearly naked. Legs a nearly uniform dark reddish; tarsi dark brown.

Taken on Cornus at Albany, N.Y. July 3, 1906.

Type Cecid. 459, N.Y. State Museum.

### Micromyia diervillae n. sp.

**Male.** Length 1.5 mm. Antennae scarcely extending to the base of the abdomen, sparsely haired, dark brown, 9 segments. Mesonotum dark brown; scutellum, postscutellum and abdomen a nearly uniform dark brown, the latter slightly yellowish distally. Legs a variable fuscous, the posterior tarsi tinged with carmine.

Taken on bush honeysuckle at Karner, N.Y. June 5, 1906.

Type Cecid. 490, N.Y. State Museum.

### Lestremia pini n. sp.

**Male.** Length 1.5 mm. Antennae probably as long as the body, rather sparsely haired, dark brown, 16 segments. Mesonotum dark brown with a very few whitish setae; scutellum light brown; postscutellum yellowish brown. Abdomen a nearly uniform grayish brown, terminal segments slightly darker. Coxae, femora and tibiae mostly whitish transparent; tarsi fuscous.

Taken on pine at Albany, N.Y. July 16, 1906.

Type Cecid. 562, N.Y. State Museum.

### Lasioptera rubra n. sp.

**Male.** Length 1.25 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 14 segments, face fuscous yellowish. Mesonotum dark brown, rather thickly clothed along its margins with fuscous scales; scutellum with numerous reddish apical setae; postscutellum dark. Abdomen deep red, rather thickly clothed with fuscous scales. Legs mostly a fuscous yellowish or reddish. Tarsi dark brown.

Bred from a variegated blister gall on Solidago rugosa at Albany, N.Y. July 15, 1906.

Type Cecid. 650, N.Y. State Museum.

### Lasioptera tuberculata n. sp.

**Male.** Length 1.25 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, yellowish basally, 14 segments, face yellowish. Mesonotum dark brown, thickly clothed

with fuscous hairs, submedian lines yellowish. Scutellum reddish brown, postscutellum dark silvery. Abdomen dark brown, darker on the basal segments. The incisures, pleurae and the distal segments pale orange. Genitalia fuscous yellowish; coxae and base of femora yellowish. Other portions of the legs nearly uniform dark brown.

Bred from a variegated blister gall on Solidago rugosa at Albany, N.Y. July 15, 1906.

Type Cecid. 650b, N.Y. State Museum.

### Lasioptera cinerea n. sp.

**Male.** Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 16 or 17 segments; head dark brown. Mesonotum and scutellum dark brown, the latter silvery white apically, postscutellum very dark brown. Abdomen dark brown, rather thickly clothed dorsally with silvery white scales. Legs mostly dark brown, lighter ventrally. Tarsi darker than femora and tibiae.

Taken on Ilex verticillata at Albany, N.Y. May 21, 1906.

Type Cecid. 73, N.Y. State Museum.

### Lasioptera viburni n. sp.

**Male.** Length 1 mm. Antennae extending to the 2d abdominal segment, sparsely haired, dark brown, at least 18 and probably a larger number of segments; eyes margined posteriorly with silvery white scales. Mesonotum dark brown, margined laterally with yellowish, anteriorly with a few sparse silvery white hairs, submedian lines yellowish. Scutellum and postscutellum nearly uniformly fuscous orange. Abdomen yellowish orange with irregular fuscous markings on the 1st, 2d, 3d and 4th abdominal segments; these marks are narrowly divided in the middle and slightly prolonged sublaterally, giving somewhat the appearance of a double row of subquadrate fuscous spots. Coxae, femora and tibiae pale yellowish straw; tarsi nearly uniformly dark brown.

Taken on maple-leaved arrowwood at Albany, N.Y. June 10, 1906.

Type Cecid. 186, N.Y. State Museum.

### Lasioptera consobrina n. sp.

**Male.** Length 1 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, brown, 18 segments; face yellowish brown with patches of whitish hairs; eyes margined posteriorly

with the same. Mesonotum dark brown, sparsely margined anteriorly and laterally with silvery white scales; posteriorly with a conspicuous patch of the same. Scutellum pale orange, apically with numerous whitish hairs, postscutellum pale orange. Abdomen dark brown; 1st segment clothed with silvery white scales, the 2d, 3d and 4th segments each with subquadrate, submedian spots clothed with yellowish white scales; 5th segment with a few whitish scales sublaterally; 6th with a few median ones along the posterior margin, and a similar patch of the same color laterally. Legs rather variable, yellowish transparent, with some dark brown dorsally. Tarsi largely and irregularly tinged with carmine.

Taken on maple-leaved arrowwood at Albany, N.Y. June 10, 1906.

Type Cecid. 183a, N.Y. State Museum.

### **Lasioptera canadensis** n. sp.

**Male.** Length 1.5 mm. Antennae hardly reaching to the base of the abdomen, sparsely haired, dark brown, 18 or 19 segments; eyes margined posteriorly with silvery white scales. Mesonotum dark brown, ornamented with fragmentary submedian lines of whitish scales posteriorly and a somewhat broken patch of the same on the lateral posterior area near the base of the wings. Scutellum dark brown, rather thickly ornamented with silvery white scales; postscutellum dark brown. Abdomen dark brown, the 4 basal segments each with conspicuous submedian quadrate silvery spots. Legs mostly pale yellowish straw; tarsi reddish or dark brown on the distal segments.

Taken on blueberry or low bushes at Albany, N.Y. May 21, 1906.

Type Cecid. 74, N.Y. State Museum.

### **Lasioptera impatientifolia** n. sp.

**Male.** Length 1.6 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, yellowish basally, 19 segments; face fuscous; eyes margined posteriorly with dull silvery scales. Mesonotum dark brown, thickly clothed with silvery and pale yellowish scales. In one specimen the mesonotum is entirely covered by scales. Scutellum dark brown with pale yellowish apically; postscutellum yellowish brown. Abdomen dark brown with the 1st segment clothed sparsely with silvery white scales; the 4th and 5th segments thickly clothed with dark brown scales, and the others more sparsely clothed with scales of the same color.

The posterior margins of the segments a dull yellowish orange; 7th and 8th segments mostly yellowish orange, the former narrowly margined posteriorly with dark brown. Genitalia dark brown. Pleurae dark brown, venter sparsely clothed with silvery white scales. Coxae fuscous yellowish; femora and tibiae dark brown, pale yellowish apically; tarsi nearly uniformly dark brown.

**Female.** Length 1.2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 23 segments; face fuscous; eyes margined posteriorly with dull silvery scales. Mesonotum a rich purplish brown, broadly margined laterally and anteriorly with dull silvery scales. Scutellum yellowish brown, postscutellum a little darker. Abdomen dark purplish brown, the segments narrowly margined posteriorly with dull silvery, that of the 2d and 3d apparently broadly interrupted along the median line. Ovipositor pale orange; legs mostly a rich brown; the femora and tibiae annulate with light yellow at the articulations.

Bred from a leaf gall of touch-me-not or snapdragon (Impatiens fulva) at Albany, N.Y. August 10, 1906.

Type Cecid. a1166, N.Y. State Museum.

### Lasioptera caryae n. sp.

**Male.** Length 2 mm. Antennae shorter than the head and thorax, sparsely clothed with fine setae, brown, 20 segments. Head dark brown with two silvery spots at the base of the antennae. Mesonotum covered with bronzy scales; scutellum and postscutellum with long scales. Pleurae with very large white silvery scales. Abdomen clothed with pale brown scales, those of the last two segments having a bluish tinge. Legs thickly clothed with scales, yellowish at the base; the tibiae and tarsi dark brown.

Taken on hickory at Albany, N.Y. June 19, 1906.

Type Cecid. 335, N.Y. State Museum.

### Lasioptera desmodii n. sp.

**Male.** Length 1 mm. Antennae extending to the base of the abdomen, sparsely clothed with fine hairs, dark brown, basally yellowish transparent, 21 or 22 segments. Mesonotum nearly uniformly dark brown, margined anteriorly and laterally with silvery white scales and with a sprinkling of the same on the margin of the nearly naked posterior median area. Scutellum brownish, rather thickly clothed with smaller white hairs and a few long apical bristles; postscutellum dark brown. Abdomen dark brown,

the 1st segment thickly clothed with snow-white hairs, the 2d and 3d and 4th segments broadly margined posteriorly with the same, the bands being wider on the median line; the 5th narrowly margined with white, the 7th brown; the 8th yellowish, the latter two margined posteriorly with long white bristles. Ventral surface dark brown with a broad median silvery white stripe. Genitalia dark brown, tipped with silvery white; coxae yellowish transparent; femora and tibiae dark brown banded at the extremities with yellowish white.

**Female.** Length 2 mm. Coloration practically as in the other sex. Ovipositor when extended probably $\frac{3}{4}$ the length of the abdomen.

Bred May 31, 1906, from stem gall on tick trefoil (Meibomia cuspidatum or M. canadensis), taken at Albany, N.Y.

Type Cecid. 88, N.Y. State Museum.

### Lasioptera corni n. sp.

**Female.** Length .9 mm. Antennae $\frac{1}{2}$ the length of the body sparsely haired, brownish black, 18 segments. Mesonotum brownish yellow, yellowish posteriorly. Submedian lines broad, narrowly separated. The median line shorter. Scutellum yellow, postscutellum yellowish. Abdomen dark brown with the 1st segment golden, the others yellow banded apically. Ovipositor yellowish. Coxae whitish transparent; femora pale; tibiae pale, brownish above toward the apex; tarsi brown.

Bred from an oval ocellate leaf gall on Cornus paniculata taken at Albany, N.Y. July 16, 1906.

Type Cecid. 764a, a1151, N.Y. State Museum.

### Lasioptera hamata n. sp.

**Female.** Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 18 segments; lower portion of face and base of antennae sparsely ornamented with white hairs; eyes margined posteriorly with the same. Mesonotum brownish black; scutellum and postscutellum dark brown. Abdomen dark brown with the 3d, 4th and 5th abdominal segments margined posteriorly with whitish scales. Terminal segments pale yellowish. Coxae dark yellowish brown; femora pale yellowish; tibiae and tarsi slightly variable, dark brown.

Taken on Solidago at Nassau, N.Y. June 14, 1906.

Type Cecid. 280, N.Y. State Museum.

### Lasioptera abhamata n. sp.

**Female.** Length 1.5 mm. Antennae scarcely extending to the base of the abdomen, sparsely haired, dark brown, 21 or 22 segments. Body nearly uniformly dark brown, the submedian lines on the mesonotum sparsely clothed with fine hairs. Legs a nearly uniform dark brown, lighter ventrally, the distal tarsal segments somewhat darker.

Taken at Karner, N.Y. June 4, 1906.

Type Cecid. 130, N.Y. State Museum.

### Lasioptera quercina n. sp.

**Female.** Length 1.5 mm. Antennae hardly extending to the base of the abdomen, stout, sparsely haired, dark brown, 18 segments. Mesonotum dark brown, scutellum and postscutellum very dark brown. Abdomen a nearly uniform reddish brown, rather thickly clothed with ferruginous hairs. Coxae yellowish or reddish yellow, semitransparent; femora and tibiae dark brown, lighter at the articulations; tarsi dark brown.

Taken on white oak at Albany, N.Y. June 1, 1906.

Type Cecid. 96, N.Y. State Museum.

### Clinorhyncha filicis n. sp.

**Female.** Length 1 mm. Antennae extending to the base of the abdomen, dark brown, sparsely haired, 10 segments. Mesonotum dark brown, submedian lines yellowish, thickly clothed with fuscous yellowish hairs. Scutellum dark brown; postscutellum brown. Abdomen dark brown basally with the 2d to 5th segments reddish brown, terminal segments yellowish. Legs a nearly uniform dark brown, lighter ventrally.

Taken on fern at Nassau, N.Y. June 24, 1906.

Type Cecid. 386, N.Y. State Museum.

### Choristoneura laeviana n. sp.

**Male.** Length 1.5 mm. Antennae short, hardly extending to the base of the abdomen, sparsely haired, dark brown, 14 segments; face reddish brown; eyes margined posteriorly with pale yellowish scales. Mesonotum dark brown with broad submedian stripes, thickly clothed with short yellowish scales; scutellum dark brown, postscutellum reddish brown. Abdomen dark brown, with the incisures and pleurae pale yellowish red. Genitalia dark brown.

Legs mostly dark brown, the tarsal segments invariably pale yellowish or reddish.

Bred September 1, 1906, from a whitish blister gall on Aster laevis taken at Albany, N.Y.

Type Cecid. a1281, N.Y. State Museum.

### Choristoneura paniculata n. sp.

**Male.** Length 2 mm. Antennae shorter than the body, sparsely white haired, black, 14 segments. Mesonotum dark brown with a pale median line. Scutellum dark brown, postscutellum a little paler. Abdomen dark brown with some similar scales; membrane and pleurae concolorous. Legs pale brown or slightly yellowish.

Bred August 10, 1906, from a yellowish or brownish oval blister gall on Aster paniculata.

Type Cecid. 757, N.Y. State Museum.

### Choristoneura basalis n. sp.

**Male.** Length 1.5 mm. Antennae $\frac{1}{4}$ the length of the body, sparsely haired, dark brown, probably composed of 14 segments; face fuscous yellowish. Mesonotum dark brown, submedian lines sparsely ornamented with yellowish hairs; scutellum yellowish brown, postscutellum yellowish. Abdomen with the 4 basal segments yellowish white, the distal segment pale orange dorsally, sparsely clothed with fuscous and yellowish scales. Genitalia fuscous; coxae pale yellowish; femora yellowish basally, dark brown distally; tibiae and tarsi dark brown.

Taken on hazel at Albany, N.Y. August 6, 1906.

Type Cecid. 739, N.Y. State Museum.

### Choristoneura liriodendri n. sp.

**Male.** Length 2.5 mm. Antennae not extending to the base of the abdomen, sparsely clothed with fine hairs, dark brown, lighter basally, 18 segments. Mesonotum dark brown, shining, clothed with long white hairs, more abundant anteriorly and seen from the side appearing like a collar. Submedian lines rather abundantly clothed with fine hairs; scutellum and postscutellum reddish; abdomen with the basal segments covered with white scales; the 2d black basally, the dark collar with 3 distal prolongations, that on the median line extends across the segment; the 3d segment has 3 dark points extending across the segment, the 4th is decidedly reddish yellow, the 5th narrow at the base and clothed with a patch

of dark scales. Legs pale yellow with the tarsi slightly darker at the tips of the segments.

Taken on tulip tree at Albany, N.Y. June 8, 1906.

Type Cecid. 291, N.Y. State Museum.

### Choristoneura caryae n. sp.

**Male.** Length 2 mm. Antennae shorter than the head and thorax, sparsely haired, dark brown, composed of 15 and probably 20 segments. Head dark brown with two silvery spots at the base of the antennae. Mesonotum covered with bronzy scales; scutellum and postscutellum with long scales; tibiae clothed with very large white patches of silvery scales. Abdomen clothed with pale brown scales, those on the last 2 segments with a bluish tinge. Legs thickly clothed with scales, pale yellowish at the base; the tibiae and tarsi dark brown.

Taken on hickory at Albany, N.Y. June 19, 1906.

Type Cecid. 334, N.Y. State Museum.

### Choristoneura abnormis n. sp.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 16 segments. Mesonotum, scutellum and postscutellum dark brown. Abdomen presumably a nearly uniform dark brown with irregular patches of whitish scales on the pleurae. Legs mostly dark brown.

Taken on Solidago at Albany, N.Y. July 24, 1906.

Type Cecid. 676, N.Y. State Museum.

### Choristoneura convoluta n. sp.

**Female.** Length 1 mm. Antennae extending to the 2d abdominal segment, sparsely haired, light brown, fuscous basally, 17 segments. Mesonotum dark brown, submedian lines ornamented with sparse yellowish setae; scutellum and postscutellum yellowish brown. Abdomen nearly uniformly dark brown; ovipositor pale orange. Legs mostly uniformly dark brown with irregular yellowish markings. Anterior tibiae yellowish; tarsi yellowish, the segments tinged with reddish brown distally; mid and posterior tarsi mostly yellowish with a faint brown annulation on the 2d segment. Distal segment dark brown.

Bred from a convolute tip gall on Solidago taken at Albany, N.Y. August 11, 1906.

Type Cecid. a1307, N.Y. State Museum.

### **Choristoneura** albomaculata n. sp.

**Female.** Length 2 mm. Antennae $\frac{1}{3}$ the length of the body, sparsely haired, pale yellowish, 18 segments. Face pale with a few scattering hairs on the front; eyes margined with whitish scales posteriorly. Mesonotum black with a pale median line; scutellum and abdomen black, the latter clothed with black scales and with six whitish spots on the lateral margin of the abdomen. Incisures reddish yellow; irregular spots of whitish scales occur below the wing insertion; ovipositor yellowish; coxae yellowish with a few white scales, the anterior and mid pair with long black setae anteriorly; femora with the basal $\frac{2}{3}$ whitish, the remainder black; tibiae black with a white line of scales down the inside; tarsi black.

Bred August 14, 1906, from a blister gall on Solidago taken at Albany, N.Y.

Type Cecid. 758, N.Y. State Museum.

### **Choristoneura cinerea** n. sp.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely clothed with fine hairs, dark brown, 25 segments; face sparsely ornamented with whitish hairs. Mesonotum a nearly uniform dark brown, submedian lines ornamented with grayish hairs; scutellum dark brown with sparse apical setae; postscutellum dark brown. Abdomen dark brown; incisures and pleurae pale whitish orange, the basal segment thickly clothed with silvery white scales; the posterior margin of the 3d abdominal segment sparsely ornamented with silvery scales; terminal segments pale orange. Coxae dark yellowish; femora yellowish white with a more or less broad fuscous band near the middle. Anterior and mid tibiae fuscous dorsally, pale yellowish ventrally. Posterior tibiae pale yellowish; tarsi fuscous, lighter ventrally.

Taken at Albany, N.Y. June 21, 1906.

Type Cecid. 341, N.Y. State Museum.

### **Choristoneura hamamelidis** n. sp.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 27 segments; face dark brown with patches of whitish scales below the insertion of the antennae; eyes margined posteriorly with silvery white. Mesonotum

shiny black, margined anteriorly and laterally with silvery white; the submedian lines ornamented with pale hairs. Scutellum dark brown, silvery white apically; postscutellum a nearly uniform dark brown. Abdomen a rich dark brown with the dorsum of the 1st abdominal segment, a minute median spot on the 2d, a broad apical band on the 3d and 4th segments, the two latter not extending to the margin, silvery white; terminal segment pale orange. Coxae and extremities of femora and tibiae yellowish transparent; tarsi a nearly uniform dark brown, lighter ventrally.

Taken on witch-hazel at Albany, N.Y. June 10, 1906.

Type Cecid. 181, N.Y. State Museum.

### Rhabdophaga acerifolia n. sp.

**Male.** Length 1.5 mm. Antennae about $\frac{2}{3}$ the length of the body, thickly clothed with whitish hairs, dark brown, 15 segments. Mesonotum dark brown; scutellum reddish brown; postscutellum dark brown and orange, the basal abdominal segment dark brown, the others light brown, all sparsely clothed with whitish hairs. Genitalia dark brown; legs variably brownish, the tarsi darker.

Taken in the vicinity of maple and other trees and shrubs at Albany, N.Y. May 17, 1906.

Type Cecid. 36, N.Y. State Museum.

### Rhabdophaga populi n. sp.

**Male.** Length 2 mm. Antennae extending nearly to the tip of the abdomen, thickly haired, dark yellowish, 18 segments. Face dark brown, eyes narrowly margined posteriorly with silvery white. Mesonotum dark brown with distinct submedian lines of silvery white hairs and groups of the same at the base of the wings. Scutellum dark brown; postscutellum reddish brown; abdomen dark brown, thinly clothed dorsally with scattering silvery hairs and rather thickly clothed laterally. Legs a nearly uniform brown dorsally, silvery white ventrally; tarsi possibly a little darker.

**Female.** Length 2.5 mm. Antennae extending to the base of the abdomen; color characters practically as in the other sex.

Bred May 23, 1906, from cocoons taken at the base of poplar buds at Albany, N.Y.

Type Cecid. 78x, N.Y. State Museum.

### Rhabdophaga absobrina n. sp.

**Male.** Length 2.5 mm. Antennae extending to the base of the abdomen, thickly clothed with long whitish hairs, dark brown, 19 segments. Face dark brown; mesonotum dark brown with distinct sublateral and submedian rows of golden yellowish hairs; scutellum and postscutellum reddish brown. Abdomen dark brown, rather thickly clothed laterally with silvery white hairs in whitish patches. Legs a variable brown, lighter ventrally; tarsi dark brown.

Taken on maple and other trees and shrubs at Albany, N.Y. May 17, 1906.

Type Cecid. 40, N.Y. State Museum.

### Rhabdophaga consobrina n. sp.

**Male.** Length 3 mm. Antennae shorter than the body, sparsely clothed with fine hairs, dark brown, 19 segments. Mesonotum dark brown, the submedian lines rather thickly clothed with dark hairs. Scutellum dark brown, thickly clothed with yellowish white hairs; postscutellum reddish anteriorly, dark brown posteriorly. Abdomen dark brown, sparsely clothed with whitish hairs; legs dark brown, lighter ventrally; tarsi darker.

Taken near maple and other trees and vines at Albany, N.Y. May 17, 1906.

Type Cecid. 39, N.Y. State Museum.

### Rhabdophaga annulata n. sp.

**Female.** Length 1 mm. Antennae a little shorter than the body, thickly haired, dark brown, fuscous yellowish basally, 14 segments. Face fuscous yellowish; mesonotum dark brown, submedian lines yellowish; scutellum dark brownish, fuscous apically; postscutellum yellowish. Abdomen dark yellowish, basal segments fuscous dorsally, terminal segments tinged with pale orange. Coxae and femora pale orange. The latter fuscous distally; tibiae pale straw variably tinged with carmine; tarsi light brown.

Taken on goldenrod or aster at Albany, N.Y. July 6, 1906.

Type Cecid. 514, N.Y. State Museum.

### Rhabdophaga borealis n. sp.

**Female.** Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, light brown, probably 14 segments. Face dark yellowish; mesonotum dark brown, lighter posteriorly, submedian lines

yellowish, ornamented with fine hairs. Scutellum slightly yellowish; abdomen a nearly uniform dark carmine; legs a nearly uniform pale brown; tarsi slightly darker.

Taken on spruce at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 159, N.Y. State Museum.

**Dasyneura bidentata** n. sp.

**Male.** Length 1.25 mm. Antennae extending to the base of the abdomen, rather sparsely clothed with fine setae, dark brown, fuscous yellowish basally, 13 segments. Face fuscous yellowish; mesonotum dark brown with distinct submedian lines; scutellum rather dark red or reddish orange; postscutellum dark red. Abdomen reddish or dark salmon; segments margined with pale yellowish posteriorly. Genitalia slightly fuscous; coxae and basal portions of femora pale yellowish; other parts of legs brownish; tarsi slightly darker, lighter ventrally.

Taken on white oak at Albany, N.Y. June 21, 1906.

Type Cecid. 344, N.Y. State Museum.

**Dasyneura cerasi** n. sp.

**Male.** Length 1 mm. Antennae apparently ½ longer than the body, thickly clothed with long setae, dark brown, yellowish basally, 12 segments. Face fuscous yellowish, mesonotum dark brown, submedian lines pale yellowish, sparsely ornamented with fine setae. Scutellum pale yellowish with sparse apical setae; postscutellum fuscous yellowish; abdomen dark yellowish fuscous, rather thickly clothed with pale yellowish hairs, basal segments slightly lighter. Legs pale straw color; tarsi slightly darker.

Taken on black cherry at Albany, N.Y. June 21, 1906.

Type Cecid. 343, N.Y. State Museum.

**Dasyneura photophila** n. sp.

**Male.** Length .75 mm. Antennae probably nearly as long as the body, sparsely haired, dark brown, probably 14 segments. Face dark brown, sparsely clothed with whitish hairs; eyes large, black, margined posteriorly with silvery white hairs. Mesonotum dark brown; scutellum yellowish; postscutellum and abdomen nearly uniform dark brown. Legs a nearly uniform dark brown.

Taken at Nassau, N.Y. June 10, 1906.

Type Cecid. 194, N.Y. State Museum.

### Dasyneura acerifolia n. sp.

**Male.** Length .75 mm. Antennae extending to the base of the abdomen, rather sparsely haired, light brown, 14 segments. Mesonotum and scutellum dark brown, abdomen brown. Legs mostly yellowish transparent, irregularly marked with dark brown, particularly the extremities of the femora and tarsi.

Taken on maple at Albany, N.Y. May 21, 1906.

Type Cecid. 72, N.Y. State Museum.

### Dasyneura setosa n. sp.

**Male.** Length .75 mm. Antennae a little shorter than the body, thickly haired, dark brown, 14 segments. Face fuscous; mesonotum dark brown, submedian lines sparsely haired; scutellum reddish brown; postscutellum fuscous yellowish brown. Abdomen dark brown, sparsely yellow haired. Coxae and base of femora yellowish brown; other portions of legs dark brown.

Taken at Nassau, N.Y. August 10, 1906.

Type Cecid. 750, N.Y. State Museum.

### Dasyneura virginica n. sp.

**Male.** Length .75 mm. Antennae extending to the 2d abdominal segment, sparsely clothed with fine hairs, dark brown, 15 segments. Mesonotum nearly uniform dark brown, lighter posteriorly, submedian lines sparsely clothed with fine hairs; scutellum variably fuscous, basally pale yellowish and with sparse setae apically; postscutellum dark brown. Abdomen dark brown with the 6th and 7th segments distinctly pale yellowish orange. Legs nearly uniform light brown, lighter ventrally; tarsi slightly darker.

Taken on witch-hazel at Albany, N.Y. June 12, 1906.

Type Cecid. 238b, N.Y. State Museum.

### Dasyneura filicis n. sp.

**Male.** Length 1.5 mm. Antennae shorter than the body, dark brown, sparsely clothed with fine hairs, 15 segments. Mesonotum yellowish laterally, slaty brown dorsally and with long dark hairs. Scutellum yellowish; postscutellum yellowish and red; abdomen yellowish red with a fuscous spot basally. Coxae, femora and

tibiae yellowish transparent, thickly clothed with grayish hairs; tarsi dark brown.

Taken on fern or wild crane's-bill at Albany, N.Y. May 17, 1906.

Type Cecid. 43, N.Y. State Museum.

### Dasyneura caricis n. sp.

**Male.** Length 1 mm. Antennae longer than the body, thickly clothed with long fuscous hairs, light brown, 16 segments. Face light brown; mesonotum dark brown with narrow submedian lines of fine setae; scutellum reddish brown with sparse apical setae; postscutellum yellowish. Abdomen yellowish brown, rather sparsely clothed with yellowish hairs; tip of genitalia dark brown; legs nearly uniform light brown; tarsi slightly darker.

Taken on Carex vulpinoidea at Albany, N.Y. June 4, 1906.

Type Cecid. 110, N.Y. State Museum.

### Dasyneura quercina n. sp.

**Male.** Length. 1.5 mm. Antennae nearly as long as the body, sparsely haired, dark brown, 16 segments. Mesonotum dark brown, submedian lines sparsely clothed with fine hairs; scutellum reddish brown; postscutellum darker. Abdomen dark brown, sparsely clothed with yellowish hairs, reddish laterally. Legs light brown, lighter ventrally; tarsi slightly darker.

Taken on oak at Albany, N.Y. May 18, 1906.

Type Cecid. 47, N.Y. State Museum.

### Dasyneura meliloti n. sp.

**Male.** Length 1 mm. Antennae a little longer than the body, sparsely haired, dark brown, 17 segments. Mesonotum dark brown, submedian lines sparsely haired; scutellum reddish brown; postscutellum slaty brown. Abdomen dark brown; membrane and pleurae yellowish. Genitalia dark brown; legs mostly dark brown.

Taken on sweet clover at Albany, N.Y. August 6, 1906.

Type Cecid. 744, N.Y. State Museum.

### Dasyneura hamamelidis n. sp.

**Male.** Length .75 mm. Antennae extending to the 3d abdominal segment, sparsely clothed with fine hairs, dark brown, 18 segments. Mesonotum nearly uniform dark brown, somewhat

lighter posteriorly, submedian lines rather distinctly ornamented with pale hairs. Scutellum a variable fuscous, basally pale yellowish and with sparse setae apically; postscutellum dark brown. Abdomen nearly uniform dark brown; legs nearly uniform light brown, lighter ventrally; tarsi slightly darker.

Taken on witch-hazel at Albany, N.Y. June 12, 1906.

Type Cecid. 238a, N.Y. State Museum.

### Dasyneura carbonaria n. sp.

**Female.** Length 1.25 mm. Antennae extending to the base of the abdomen, thickly haired, dark brown, 12 segments. Mesonotum dark brown, submedian lines indistinct; scutellum, postscutellum and abdomen deep carmine, the first two and the terminal abdominal segments tinged with yellowish. Legs a nearly uniform dark brown.

Bred from a blister Solidago gall apparently identical with that inhabited by Lasioptera carbonifera Felt. Taken at Albany, N.Y. July 14, 1906.

Type Cecid. 713, N.Y. State Museum.

### Dasyneura borealis n. sp.

**Female.** Length 1 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown, probably 14 segments. Mesonotum dark brown, lighter posteriorly, submedian lines distinctly yellowish; scutellum yellowish carmine; postscutellum and abdomen light yellowish red. Legs light brown, lighter ventrally; tarsi darker.

Taken on spruce at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 160, N.Y. State Museum.

### Dasyneura denticulata n. sp.

**Female.** Length 1.5 mm. Antennae a little shorter than the body, sparsely haired, reddish brown, 14 segments. Face dark brown; mesonotum dark carmine; scutellum tinged with yellowish; postscutellum and abdomen dark carmine. Femora and tibiae yellowish brown; tarsi rather dark brown with suggestions of annulations.

Taken on spruce at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 156, N.Y. State Museum.

### Dasyneura consobrina n. sp.

**Female.** Length 1.5 mm. Antennae extending to the 3d abdominal segment, sparsely haired, dark brown, 17 segments. Face and mesonotum dark brown, submedian lines pale, sparsely ornamented with fine setae. Scutellum and postscutellum bright orange, the former with sparse apical setae. Abdomen slightly fuscous orange, the incisures and pleurae bright orange, terminal segments yellowish, sparsely ornamented with fine pale setae. Coxae and femora pale straw; tibiae and tarsi rather dark brown, the former lighter ventrally.

Taken on white pine at Albany, N.Y. June 11, 1906.

Type Cecid. 215, N.Y. State Museum.

### Asphondylia fulvopedalis n. sp.

**Male.** Length 2 mm. Antennae as long as the body, sparsely haired, light brown, fuscous basally, 14 segments. Mesonotum dark brown, submedian lines lighter; scutellum and postscutellum dark brown, abdomen a nearly uniform dark brown, the segments narrowly margined posteriorly with yellowish brown and sparsely clothed with fine yellowish hairs. Legs a nearly uniform fuscous straw, tarsal segments dull yellowish.

Taken on Solidago at Westfield, N.Y. July 11, 1906.

Type Cecid. 546, N.Y. State Museum.

### Asphondylia transversa n. sp.

**Male.** Length 1.25 mm. Antennae extending to the 3d abdominal segment, naked, dark brown, 14 segments. Mesonotum very dark brown, submedian lines with setae; scutellum and postscutellum reddish brown, the former with apical setae. Abdomen dark brown, rather thickly clothed with yellowish setae. Legs yellowish red; tibiae and basal tarsal segments slightly lighter apically, the distal tarsal segments darker.

Taken at Albany, N.Y. May 18, 1906.

Type Cecid. 53, N.Y. State Museum.

### Asphondylia multifila n. sp.

**Male.** Length 1.25 mm. Antennae extending to the base of the abdomen, sparsely haired, light brown, probably 13 or 14

segments. Face yellowish brown; mesonotum dark brown; scutellum reddish brown, postscutellum a little lighter. Abdomen a nearly uniform dark brown. Legs pale yellowish brown; tarsi a little darker.

Taken on white oak, Viburnum lentago and witch-hazel at Albany, N.Y. June 1, 1906.

Type Cecid. 95, N.Y. State Museum.

### Asphondylia altifila n. sp.

**Male.** Length 1.5 mm. Antennae about as long as the body, thickly clothed with fine white hairs, dark brown, 14 segments. Mesonotum very dark brown, submedian lines paler, ornamented with sparse hairs; scutellum and postscutellum reddish brown. Abdomen dark reddish brown, rather thickly clothed with golden yellowish hairs, giving an appearance of a white lateral stripe. Legs a nearly uniform fuscous straw color; tarsi slightly darker.

Taken on blueberry at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 177, N.Y. State Museum.

### Asphondylia carpini n. sp.

**Female.** Length .75 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown, 14 segments. Face pale yellowish; mesonotum fuscous orange with submedian lines yellowish, sparsely ornamented with fine setae. Scutellum pale yellowish with sparse apical setae; postscutellum fuscous yellowish. Abdomen pale fuscous orange, rather sparsely clothed with fuscous setae. Legs fuscous, pale yellowish basally, tarsi a little darker.

Taken on ironwood or blue beech at Albany, N.Y. June 21, 1906.

Type Cecid. 346, N.Y. State Museum.

### Asphondylia rubi n. sp.

**Female.** Length 1.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, dark brown, 14 segments. Mesonotum yellowish brown, submedian lines ornamented with long, yellowish setae. Scutellum reddish brown with sparse apical setae, postscutellum dark brown. Abdomen dark reddish with irregular dark brown markings on the dorsum of the 2d, 3d and 7th abdominal segments. Coxae mostly fuscous, anterior and mid femora mostly black, narrowly ringed with pale yellowish, posterior

femora with basal half pale yellowish, distal half fuscous; tibiae black with articulations yellowish or tinged with carmine, fore and mid tarsi black, the segments narrowly ringed basally with yellowish or yellowish white, posterior tarsi mostly yellowish with sparse, irregular, fuscous markings on the middle of the second segment, distal segments dark brown or fuscous.

Taken on high blackberry at Karner, N.Y. July 24, 1906.

Type Cecid. 685, N.Y. State Museum.

### Rhopalomyia fusiformis n. sp.

**Male.** Length 2 mm. Antennae as long as the body, sparsely haired, yellowish gray, 19 segments. Mesonotum light brown, submedian lines yellowish, uniting posteriorly in a median yellowish area; scutellum fuscous yellowish with sparse apical setae; postscutellum yellowish brown. Abdomen dark fuscous yellowish, slightly darker basally, sparsely clothed with fine fuscous hairs. Genitalia very dark; legs a nearly uniform yellowish fuscous, distal tarsal segments somewhat variably tinged with pale carmine.

Bred from a ribbed green or reddish fusiform stemmed gall on leaf or stem of Solidago taken at Albany, N.Y. July 16, 1906.

Type Cecid. a1150, N.Y. State Museum.

### Rhopalomyia pini n. sp.

**Male.** Length 2.5 mm. Antennae probably nearly as long as the body, rather thickly clothed with fine whitish hairs with variable light yellowish, 18 segments. Face dark brown; mesonotum reddish brown, the posterior median area lighter, the submedian lines with slaty colored hairs. Scutellum yellowish brown; postscutellum reddish brown. Abdomen yellowish brown, rather thickly clothed with slaty colored hairs. Legs a nearly uniform slaty brown.

Taken flying to a small white pine at Albany, N.Y. June 4, 1906.

Type Cecid. 116, N.Y. State Museum.

### Rhopalomyia racemicola n. sp.

**Male.** Length 2.5 mm. Antennae as long as the body, sparsely white haired, fuscous yellowish, some of the terminal segments reddish, 18 or 20 segments. Mesonotum reddish brown, submedian lines yellowish, broad, rather thickly haired. Scutellum and post-

scutellum yellowish red; abdomen yellowish red, thickly haired, basal segments somewhat fuscous. Genitalia reddish; coxae fuscous yellowish; femora, tibiae and tarsi mostly a variable reddish.

**Female.** Length 2.5 mm. Antennae composed of 18 segments. Other characters about as in the male. Ovipositor when extended nearly as long as the body.

Bred from subglobular turnip-shaped bud galls on Solidago canadensis taken at Asheville, N.C. September 16, 1906.

Type Cecid. a1605, N.Y. State Museum.

### **Rhopalomyia major** n. sp.

**Male.** Length 3 mm. Antennae longer than the body, rather thickly clothed with whorls of long whitish hairs, the body of the segments dark brown, 22–23 segments. Face yellowish brown; mesonotum a nearly uniform dark brown, submedian lines distinct with fuscous hairs and similar hairs on the lateral margin. Scutellum and postscutellum yellowish brown, the later fuscous laterally. Abdomen yellowish brown, rather thickly clothed with long fuscous hairs. Legs brownish black, the femero-tibio articulation tinged with reddish; tarsi dark brown.

Taken in trap lantern at Huguenot Park, S.I. May 31, 1906.

Type Cecid. 90, N.Y. State Museum.

### **Rhopalomyia acerifolia** n. sp.

**Female.** Length 1.5 mm. Antennae not extending to the base of the abdomen, sparsely haired, light brown, 12 segments. Face yellowish; mesonotum yellowish brown; abdomen light yellowish, slightly fuscous at the extremities. Legs with femora and tibiae yellowish transparent; tarsi dark brown, the anterior banded with yellowish at the basal articulations, the posterior with the basal segment yellowish.

Taken in the vicinity of maple and other trees and vines at Albany, N.Y. May 1, 1906.

Type Cecid. 38, N.Y. State Museum.

### **Oligotrophus tiliaceus** n. sp.

**Male.** Length .75 mm. Antennae hardly reaching to the base of the abdomen, sparsely haired, dark brown, 12 segments. Face reddish brown; mesonotum dark brown, submedian lines distinct

with brownish hairs. Scutellum reddish brown; postscutellum dark brown. Abdomen rather light brown with a yellowish cast laterally. Legs pale brown, lighter ventrally; tarsi a little darker.

Taken on basswood at Westfield, N.Y. May 23, 1906.

Type Cecid. 83, N. Y. State Museum.

### Oligotrophus brevicornis n. sp.

**Male.** Length 1 mm. Antennae extending to the base of the abdomen, rather thickly haired, dark brown, yellowish basally, 12 segments. Face pale yellowish; mesonotum dark brown, submedian lines yellowish, sparsely ornamented with fine setae. Scutellum reddish orange; postscutellum dark brown. Abdomen a nearly uniform fuscous yellowish. Genitalia somewhat fuscous; legs a nearly uniform pale straw, the distal segments dark brown.

Taken on Solidago at Nassau, N.Y. June 14, 1906.

Type Cecid. 281, N.Y. State Museum.

### Oligotrophus azaleae n. sp.

**Male.** Length 1.5 mm. Antennae not extending to the base of the abdomen, sparsely haired, light brown, 12 segments. Mesonotum dark brown with submedian lines of dark hairs. Scutellum reddish brown; postscutellum lighter; abdomen yellowish. Genitalia dark brown; femora and tibiae yellowish brown; tarsi brown tinged with reddish, the 2d tarsal segment more than twice the diameter of the following one, and as long as the 3d and 4th combined.

Taken on azalea at Albany, N.Y. May 18, 1906.

Type Cecid. 48, N.Y. State Museum.

### Oligotrophus aceris n. sp.

**Male.** Length .75 mm. Antennae extending to the 3d abdominal segment, sparsely haired, dark brown, 13 segments. Face and mesonotum dark brown, the latter with distinct submedian lines of yellowish hairs. Scutellum reddish brown; postscutellum yellowish. Abdomen dark brown, sparsely clothed with yellowish hairs; legs reddish brown and yellowish, lighter ventrally, the deeper color at the extremities of the femora, distally on the tibiae and on the distal tarsal segments.

Taken on soft maple at Albany, N.Y. May 21, 1906.

Type Cecid. 66, N.Y. State Museum.

### Oligotrophus rhoinus n. sp.

**Male.** Length .75 mm. Antennae a little longer than the body, sparsely haired, light brown, 13 or 14 segments. Mesonotum dark brown; scutellum light brown with sparse apical setae; postscutellum yellowish brown. Abdomen a somewhat variable yellowish brown, the anterior four segments irregularly marked near the median line with dark brown. Legs pale yellowish brown; tarsi darker.

Taken on sumac at Albany, N.Y. June 1, 1906.

Type Cecid. 94, N.Y. State Museum.

### Oligotrophus thalactri n. sp.

**Male.** Length 1.5 mm. Antennae shorter than the body, sparsely haired, light brown, yellowish basally, 14 segments. Face yellowish; mesonotum light yellowish brown, submedian lines yellowish. Scutellum and postscutellum pale yellowish. Abdomen yellowish, sparsely clothed with light hairs. Coxae and basal portion of femora pale yellow, the remainder of the legs fuscous yellow.

Taken on early meadow rue at Albany, N.Y. June 1, 1906.

Type Cecid. 98, N.Y. State Museum.

### Oligotrophus nodosus n. sp.

**Male.** Length 1.25 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown, 14 segments. Face and mesonotum dark brown, abdomen reddish brown, dorsal incisures orange-brown. Legs yellow with reddish tints; tibiae and tarsi fuscous apically.

Taken on hornbeam or water beech near pine at Albany, N.Y. April 10, 1906.

Type Cecid. 10, N.Y. State Museum.

### Oligotrophus tsugae n. sp.

**Male.** Length 1.5 mm. Antennae extending to the middle of the abdomen, rather thickly haired, dark reddish brown, 15 segments. Face dark reddish brown; mesonotum dark brown; scutellum, postscutellum and abdomen dark reddish. Legs a nearly uniform pale straw, lighter ventrally; tarsi darker.

Taken on hemlock at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 165, N.Y. State Museum.

### Oligotrophus acerifolius n. sp.

**Male.** Length 1.5 mm. Antennae probably nearly as long as the body, sparsely clothed with long hairs, dark brown, 15 segments. Mesonotum dark brown; scutellum and postscutellum reddish brown, the basal abdominal segments dark brown, the others reddish, spotted with carmine. Genitalia dark brown; legs a variable brown, lighter ventrally; tarsi slightly darker.

Taken on maple or other trees and shrubs at Albany, N.Y. May 17, 1906.

Type Cecid. 33, N.Y. State Museum.

### Oligotrophus pini n. sp.

**Male.** Length 2.5 mm. Antennae longer than the body sparsely clothed with long whitish hairs, dark brown, 16 segments. Head and mesonotum dark brown, the latter reddish posteriorly. Scutellum and postscutellum reddish. Abdomen yellowish red; coxae pale yellowish, femora light brown distally, lighter ventrally; tibiae and tarsi light brown, the former somewhat darker distally, the terminal tarsal segments somewhat darker.

Taken on pine at Albany, N.Y. May 26, 1906.

Type Cecid. 87, N.Y. State Museum.

### Oligotrophus cornifolius n. sp.

**Female.** Length 1.25 mm. Antennae extending to the 3d abdominal segment, reddish brown, sparsely haired, 13 segments. Mesonotum dark brown, submedian lines and the median area posteriorly yellowish. Scutellum yellowish red with numerous yellowish apical setae; postscutellum yellowish. Abdomen yellowish with the basal segments tinged with red, the 1st slightly darker. Femora and tibiae yellowish tinged with red; tarsi somewhat darker, tinged with red, color somewhat variable.

Taken on Cornus florida at Albany, N.Y. May 18, 1906.

Type Cecid. 49c, N.Y. State Museum.

### Oligotrophus caryae n. sp.

**Female.** Length .75 mm. Antennae extending to the middle of the abdomen, sparsely haired, light brown, 14 segments. Face yellowish; mesonotum black; scutellum and postscutellum reddish brown. Abdomen reddish brown with the segments margined

posteriorly with dark brown; terminal segment and ovipositor light yellow. Coxae and basal portion of femora, distal portion of femora, tibiae and tarsi a variable straw-brown.

Taken on hickory at Albany, N.Y. June 10, 1906.

Type Cecid. 102, N.Y. State Museum.

### Hormomyia americana n. sp.

**Male.** Length 5 mm. Antennae as long as the body, sparsely clothed with fine hairs, fuscous yellowish, distal segments tinged with carmine, 25 segments. Face yellowish brown; mesonotum with the anterior median triangular area and the posterior sublateral irregular area dark brown, the median posterior area, the oblique sublateral anterior area, and the lateral area bordering the posterior submedian darker area, fuscous yellowish. Scutellum yellowish, postscutellum yellowish anteriorly and laterally, black on the median posterior area. Abdomen semitransparent, yellowish, each segment tinged with orange basally, the 6th and 7th segments being nearly suffused with orange. Genitalia reddish brown with fuscous markings. Coxae fuscous yellowish tinged with reddish; femora and tibiae fuscous yellowish; tarsi slightly darker tinged with reddish.

Taken in a trap lantern at Nassau, N.Y. May 31, 1906.

Type Cecid. 91, N.Y. State Museum.

### Bremia filicis n. sp.

**Male.** Length 1.5 mm. Antennae twice the length of the body, rather thickly clothed with brown hairs, fuscous, 14 segments. Mesonotum fuscous; scutellum and postscutellum yellowish. Abdomen fuscous, clothed with long hairs. Legs long, slender, the anterior ones fuscous, the posterior gray.

Taken on fern at Karner, N.Y. June 26, 1906.

Type Cecid. 397, N.Y. State Museum.

### Bremia hamamelidis n. sp.

**Male.** Length 1.15 mm. Antennae longer than the body, rather thickly clothed with long hairs, fuscous, 14 segments. Body fuscous, the abdomen clothed with pale hairs. Legs a nearly uniform pale straw color.

Taken on witch-hazel at Albany, N.Y. June 27, 1906.

Type Cecid. 401, N.Y. State Museum.

### Bremia podophylli n. sp.

**Male.** Length 1.25 mm. Antennae probably twice as long as the body, thickly clothed with coarse hairs, dark brown, yellowish basally, 14 segments. Face pale yellowish; mesonotum dark brown, submedian lines distinct, yellowish, sparsely ornamented with pale setae. Scutellum light yellow with sparse apical setae; postscutellum light yellow; abdomen yellowish brown, rather thickly clothed with coarse setae, posterior margins of the segments and genitalia slightly fuscous. Legs a nearly uniform dark brown.

Taken on May-apple at Albany, N.Y. June 21, 1906.

Type Cecid. 352, N.Y. State Museum.

### Dicrodiplosis podophylli n. sp.

**Male.** Length 2 mm. Antennae about as long as the body, thickly clothed with rather coarse hairs, rather dark brown, yellowish basally, 14 segments. Face yellowish; mesonotum dark brown with a median yellowish area posteriorly, submedian lines and scutellum yellowish, the latter with sparse apical setae; postscutellum yellowish. Abdomen reddish brown, basal segment slightly darker dorsally, each segment with a more or less distinct row of fuscous hairs along the posterior margin. Legs a nearly uniform pale brown, lighter ventrally; tarsi slightly darker.

Taken on May-apple or mandrake at Albany, N.Y. June 11, 1906.

Type Cecid. 207, N.Y. State Museum.

### Mycodiplosis alternata n. sp.

**Male.** Length 1.5 mm. Antennae probably longer than the body, rather thickly clothed with fine hairs alternately yellowish and reddish, the larger swellings of the segments lighter, the smaller and the distal portions of the stem darker, 14 segments. Face and mesonotum dark brown, the latter with a narrow margined yellowish area posteriorly, submedian lines yellowish, sparsely clothed with fine setae. Scutellum yellowish reddish, dark brown laterally; postscutellum dark brown. Abdomen somewhat mottled with brown, darker laterally, the segments rather thickly clothed with fine yellowish hairs. Coxae yellowish transparent, femora pale yellowish with rather indistinct brownish annulations basally

and subapically; tibiae pale yellowish with more distinct fuscous annulations subbasally and apically. Tarsi with the first segment yellowish fuscous, the others yellowish orange or pale orange and with distinct fuscous annulations distally except the last segment which is entirely pale orange.

Taken on May-apple or mandrake at Albany, N.Y. June 11, 1906.

Type Cecid. 209, N.Y. State Museum.

### Mycodiplosis lobata n. sp.

**Male.** Length 1 mm. Antennae about as long as the body, rather thickly clothed with fine hairs, light brown, yellowish basally, 14 segments. Face yellowish; mesonotum rather dark brown, yellowish posteriorly, submedian lines yellowish. Scutellum yellowish; postscutellum slaty brown. Abdomen rather dark salmon. Legs a nearly uniform dark straw; tarsi darker.

Taken on blueberry at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 176, N.Y. State Museum.

### Mycodiplosis minuta n. sp.

**Male.** Length .4 mm. Antennae about one half longer than the body, rather thickly clothed with fine hairs, light brown, 14 segments. Mesonotum reddish brown; scutellum fuscous yellowish. Abdomen reddish brown with the 4th and 5th segments fuscous. Genitalia pale yellowish; legs a nearly uniform pale brown.

Taken at Nassau, N.Y. June 14, 1906.

Type Cecid. 290, N.Y. State Museum.

### Mycodiplosis acerifolia n. sp.

**Male.** Length 2.5 mm. Antennae as long as the body, thickly clothed with fine hairs, light brown, 14 segments. Mesonotum reddish brown anteriorly, yellowish posteriorly; scutellum reddish brown; postscutellum yellowish. Abdomen yellowish transparent except for a conspicuous black spot on the basal abdominal, segments and a reddish tint ventrally at the posterior extremity. Legs fuscous yellowish, lighter ventrally.

Taken on maple or other trees and vines at Albany, N.Y. May 17, 1906.

Type Cecid. 37, N.Y. State Museum.

### Mycodiplosis pini n. sp.

**Male.** Length .75 mm. Antennae one fourth longer than the body, thickly clothed with fine hairs, light brown, 14 segments. Face fuscous yellow; mesonotum fuscous brown, submedian lines pale yellowish. Scutellum light fuscous yellowish, postscutellum darker. Abdomen pale reddish brown with a golden fuscous spot on the 2d and 3d abdominal segments. Legs a nearly uniform straw-brown.

Taken on pine at Albany, N. Y June 21, 1906.

Type Cecid. 348, N.Y. State Museum.

### Mycodiplosis coryli n. sp.

**Male.** Length 1.5 mm. Antennae nearly as long as the body, rather thickly clothed with fine hairs, light straw-brown, 14 segments. Face yellowish fuscous; mesonotum rather pale orange with a slightly dusky broad marginal stripe, the lateral margin of the submedian yellowish lines sparsely ornamented with pale setae. Scutellum pale orange; postscutellum slightly darker. Abdomen pale orange with the two basal segments and genitalia fuscous. Legs mostly a pale straw color, variably tinged with carmine.

Taken on hazel at Albany, N.Y. June 12, 1906.

Type Cecid. 237, N.Y. State Museum.

### Mycodiplosis caricis n. sp.

**Male.** Length 1 mm. Antennae one half longer than the body, thickly clothed with long hairs, light brown, 14 segments. Face pale yellowish; mesonotum dark brown, submedian lines yellow, rather thickly ornamented with pale hairs. Scutellum light yellow with sparse apical setae; postscutellum orange-yellow. Abdomen dark fuscous yellow with the terminal segments pale orange, thickly clothed with pale setae. Genitalia fuscous yellow; legs a nearly uniform pale straw color.

Taken on sedge at Nassau, N.Y. June 15, 1906.

Type Cecid. 292, N.Y. State Museum.

### Mycodiplosis cyanococci n. sp.

**Male.** Length 1 mm. Antennae fully one half longer than the body, rather thickly haired, light brown, 14 segments.

Face yellowish brown; mesonotum pale brown, submedian lines yellowish with sparse setae. Scutellum light yellowish bordered with carmine laterally; postscutellum and abdomen dark brown. Legs a nearly uniform pale straw with dark brown dorsally on the apex of the femora; tarsi slightly darker.

Taken on blueberry at Karner, N.Y. June 4, 1906.

Type Cecid. 136, N.Y. State Museum.

### Mycodiplosis acerina n. sp.

**Male.** Length 1 mm. Antennae about as long as the body, thickly clothed with fine hairs, light brown, 14 segments. Face fuscous yellowish; mesonotum dark brown, submedian lines pale, rather thickly clothed with fuscous hairs; scutellum pale orange; postscutellum and abdomen a variable dark orange, the latter rather thickly clothed with fine fuscous hairs. Legs rather dark brown, lighter ventrally.

Taken on soft maple and on chokecherry beside soft maple at Albany, N.Y. June 15, 1906.

Type Cecid. 269, 270, N.Y. State Museum.

### Mycodiplosis hudsoni n. sp.

**Male.** Length 1.5 mm. Antennae about twice as long as the body, thickly clothed with fine hairs, light brown, yellowish basally, 14 segments. Face pale yellowish; mesonotum dark reddish yellow, submedian lines sparsely ornamented with hairs; scutellum and postscutellum dark reddish; abdomen reddish carmine with indistinct fuscous markings at the base. Genitalia yellowish; coxae reddish anteriorly; femora and tibiae dark brown, yellowish ventrally, the middle and posterior femora and tibiae a nearly uniform pale yellowish; the femoro-tibio and tibio-tarsal articulations tinged with carmine; tarsi a variable yellowish brown.

Taken on soft maple at Albany, N.Y. June 10, 1906.

Type Cecid. 188, N.Y. State Museum.

### Mycodiplosis emarginata n. sp.

**Male.** Length .75 mm. Antennae fully twice as long as the body, thickly clothed with fine hairs, pale brown, 14 segments. Face yellowish; mesonotum pale orange-yellow; scutellum, post-

scutellum and abdomen pale lemon-yellow. Legs a nearly uniform pale straw.

Taken at Nassau, N.Y. June 10, 1906.

Type Cecid. 191, N.Y. State Museum.

### **Mycodiplosis quercina** n. sp.

**Male.** Length 1.5 mm. Antennae about one fifth longer than the body, thickly clothed with fine yellowish hairs, light brown, 14 segments. Face pale yellowish; mesonotum rather dark brown, yellowish posteriorly, submedian lines yellowish, sparsely ornamented with fine setae. Scutellum pale reddish yellow with numerous apical setae; postscutellum pale yellowish. Abdomen yellowish brown, rather thickly clothed with fine whitish setae; pleurae yellowish transparent; legs a nearly uniform pale brown.

Taken on white oak near soft maple and chokecherry at Albany, N.Y. June 15, 1906.

Type Cecid. 271, N.Y. State Museum.

### **Mycodiplosis viburni** n. sp.

**Male.** Length 1.5 mm. Antennae nearly twice the length of the body, rather thickly clothed with brown hairs, light brown, 14 segments. Face dark brown, mouth parts pale yellowish; mesonotum rather dark brown with narrow lighter submedian lines. Scutellum light brown, clothed with long brownish apical setae; postscutellum yellowish. Abdomen light yellowish with the posterior margins of the segments dark brown and laterally about the middle of each segment a short dark brown curved line suggesting the posterior border of subsegments. Genitalia orange-yellow. Legs pale straw-yellow; femora and tibiae slightly fuscous distally; tarsi light brownish apically.

Taken on Viburnum lentago at Albany, N.Y. June 1, 1906.

Type Cecid. 89, N.Y. State Museum.

### **Mycodiplosis tsugae** n. sp.

**Male.** Length 1 mm. Antennae twice as long as the body, thickly clothed with fine hairs, light brown, 14 segments. Face yellowish; mesonotum dark brown, lighter posteriorly, submedian lines yellowish; scutellum yellowish apically, rather thickly clothed

with fine hairs. Abdomen fuscous yellowish; legs rather dark brown, the ventral surface and base of femora paler.

Taken on hemlock at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 168a, N.Y. State Museum.

### Contarinia balsamifera n. sp.

**Male.** Length 1 mm. Antennae about twice as long as the body, thickly haired, light brown, 14 segments. Face yellowish brown; mesonotum dark brown, the posterior median area lighter, submedian lines yellowish. Scutellum yellowish carmine, postscutellum and abdomen light yellowish red. Legs nearly uniform light brown, lighter ventrally, tarsi darker.

Taken on balsam at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 143, 144, N.Y. State Museum.

### Contarinia sambucifolia n. sp.

**Male.** Length 1 mm. Antennae about twice the length of the body, thickly clothed with hairs, dark brown, yellowish basally, 14 segments. Face pale yellowish; mesonotum dark brown, lighter posteriorly, submedian lines yellowish. Scutellum yellowish apically, postscutellum and abdomen pale salmon. Legs nearly uniform pale straw, irregularly tinged with carmine at the articulations, tarsi brownish dorsally.

Taken on elder at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 153, N.Y. State Museum.

### Contarinia filicis n. sp.

**Male.** Length 2.5 mm. Antennae longer than the body, thickly clothed with fine hairs, light brown, 14 segments. Mesonotum yellowish with a broad median area anteriorly, broad sublateral areas not quite extending to the anterior margin and scutellum slaty brown. Abdomen yellowish. Legs yellowish transparent ventrally, light brown dorsally, particularly the mid tibiae and tarsi.

Taken on ferns at Karner, N.Y. May 16, 1906.

Type Cecid. 20, N.Y. State Museum.

### Contarinia trifolii n. sp.

**Male.** Length .75 mm. Antennae about twice the length of the body, thickly haired, light brown, 14 segments. Face yel-

lowish; mesonotum yellowish brown; scutellum, postscutellum and abdomen yellowish, the latter sparsely clothed with fuscous hairs. Legs variable yellowish transparent, tarsi slightly darker.

Taken on clover at Albany, N.Y. June 1, 1906.

Type Cecid. 108, N.Y. State Museum.

### **Contarinia ampelophila** n. sp.

**Male.** Length .75 mm. Antennae nearly twice the length of the body, thickly clothed with fine hairs, pale brown, 14 segments. Face and mesonotum dark brown. Scutellum reddish brown, postscutellum darker; abdomen brownish red. Legs straw-yellow, tarsi a little darker apically.

Taken at Albany, N.Y. April 28, 1906, on grapevine.

Type Cecid. 9, N.Y. State Museum.

### **Contarinia caryae** n. sp.

**Male.** Length .75 mm. Antennae longer than the body, thickly haired, pale, 14 segments. Entire insect yellowish with the exception of a dark spot on the dorsum of the abdomen. Legs pale yellowish, tarsi fuscous.

Taken at Albany, N.Y. June 19, 1906, on hickory.

Type Cecid. 332, N.Y. State Museum.

### **Contarinia viburni** n. sp.

**Male.** Length 1 mm. Antennae about $\frac{1}{4}$ longer than the body, rather thickly clothed with dark hairs, pale straw, 14 segments. Face yellowish; mesonotum pale yellowish orange, slightly tinged with carmine dorsally. Scutellum and postscutellum pale orange. Abdomen bright orange, with a distinct, black or fuscous area basally. Legs pale straw, the articulations tinged with carmine.

Taken on maple-leaved arrowwood, Albany, N.Y. June 11, 1906.

Type Cecid. 210, N.Y. State Museum.

### **Cecidomyia albotarsa** n. sp.

**Male.** Length 2 mm. Antennae a little longer than the body, sparsely haired, light brown, 14 segments. Mesonotum yellowish, thinly clothed with black hairs. Scutellum fuscous. Abdomen yellowish, the apex of the segments being clothed with long, black

hairs, the extremity yellowish. Legs thickly clothed with hairlike scales, yellowish basally; tibiae black, first joint of tarsi dark, the second joint of the anterior tarsi white, the remainder fuscous, posterior tarsi with all the joints but the first white.

Taken on hickory at Albany, N.Y. June 19, 1906

Type Cecid. 330, N.Y. State Museum.

### Cecidomyia claytoniae n. sp.

**Male.** Length 1.5 mm. Antennae longer than the body, thickly clothed with fine hairs, light brown, 14 segments. Face reddish; mesonotum dark brown with paler sublateral lines and lighter on the median posterior area. Scutellum reddish, postscutellum and probably abdomen reddish brown, the latter sparsely clothed with yellowish hairs. Legs dark brown, lighter ventrally, tarsi straw-yellow.

Taken on Claytonia virginica at Albany, N.Y. May 18, 1906.

Type Cecid. 46, N.Y. State Museum.

### Cecidomyia fragariae n. sp.

**Male.** Length .75 mm. Antennae about twice as long as the body, rather thickly clothed with fine hairs, a light straw-brown, 14 segments. Mesonotum dark carmine, submedian lines yellowish. Scutellum tinged with carmine, postscutellum yellowish. Abdomen pale yellowish, with a median dorsal orange spot on the second and third segments. Legs a nearly uniform pale straw, terminal tarsal segments light brown.

Taken on strawberry at Albany, N.Y. June 18, 1906.

Type Cecid. 328 N.Y. State Museum.

### Cecidomyia orbiculata n. sp.

**Male.** Length 3 mm. Antennae about as long as the body, rather thickly clothed with fine hairs, dark brown, 14 segments. Face dark yellowish brown; mesonotum dark brown, yellowish red laterally, submedian lines narrow, yellowish, sparsely ornamented with pale hairs. Scutellum rather dark red with fuscous apical hairs, postscutellum darker. Abdomen fuscous brown dorsally, the sclerites slightly darker than the pleurae and incisures, each

segment posteriorly with a row of stout, light brown hairs. Legs nearly uniform dark straw, lighter ventrally.

Taken on common locust at Albany, N.Y. June 10, 1906.

Type Cecid. 180, N.Y. State Museum.

### **Cecidomyia photophila** n. sp.

**Male.** Length 1 mm. Antennae fully ½ longer than the body, thickly clothed with coarse setae, dark brown, 14 segments. Mesonotum yellowish brown, submedian lines indistinct, sparsely clothed with fine setae. Scutellum reddish brown with sparse apical setae, postscutellum dark brown. Abdomen bright carmine, rather thickly clothed with fine, yellowish setae. Legs a nearly uniform reddish brown.

Taken in trap lantern at Newport, N.Y. June 16, 1906.

Type Cecid. 323, N.Y. State Museum.

### **Cecidomyia recurvata** n. sp.

**Male.** Length 1 mm. Antennae probably ¼ longer than the body, sparsely clothed with fine hairs, pale straw, 14 segments. Face yellowish, thorax pale yellowish. Abdomen pale yellowish with a reddish tint basally and apically on the ventral surface. Legs pale yellowish white, extreme tips of the tarsi slightly dusky.

Taken in trap lantern at Poughkeepsie, N.Y. June 21, 1906.

Type Cecid. 361, N.Y. State Museum.

### **Cecidomyia emarginata** n. sp.

**Male.** Length .75 mm. Antennae longer than the body, thickly clothed with fine hairs, dark brown, 14 segments. Face yellowish; mesonotum pale reddish, the anterior, median and sublateral posterior areas slightly darker. Abdomen yellowish red with irregular, carmine markings. Legs light brown, lighter ventrally, tarsi slightly darker.

Taken on maple and other vines and shrubs at Albany, N. Y. May 17, 1906.

Type Cecid. 34, N.Y. State Museum.

### **Cecidomyia obesa** n. sp.

**Male.** Length 1.5 mm. Antennae as long as the body, rather thickly clothed with fine hairs, bright carmine, 14 segments. Face

pale yellowish; mesonotum and scutellum dark carmine, postscutellum fuscous. Abdomen dark carmine. Legs nearly uniform pale straw, tarsi slightly darker.

Taken on hemlock at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 167, N.Y. State Museum.

### Cecidomyia carpini n. sp.

**Male.** Length 1.25 mm. Antennae about ¼ longer than the body, thickly clothed with fine hairs, light brown, 14 segments. Basal antennal segments and face fuscous yellowish; mesonotum dark brown or black with pale submedian lines, sparsely clothed with fine setae. Scutellum dark orange, sparsely clothed with yellowish setae, postscutellum fuscous orange. Abdomen reddish brown with the pleurae and terminal segments dark yellowish, rather thickly clothed with yellowish setae. Legs brownish, yellowish red basally, lighter ventrally.

Taken on ironwood or blue beech at Albany, N.Y. June 21, 1906.

Type Cecid. 347, N.Y. State Museum.

### Cecidomyia angulata n. sp.

**Male.** Length .75 mm. Antennae longer than the body, thickly clothed with fine hairs, pale yellowish, 14 segments. Entire insect, with the exception of a dark spot on the dorsum of the body, is yellowish. Legs rather thickly clothed with narrow scales, a nearly uniform pale straw.

Taken on hickory at Albany, N.Y. June 19, 1906.

Type Cecid. 332, N.Y. State Museum.

### Cecidomyia hudsoni n. sp.

**Male.** Length 2 mm. Antennae a little longer than the body, rather sparsely haired, dark brown, 14 segments. Mesonotum light brown with an indistinct yellowish, median line and a similar color on the humeri, submedian lines sparsely ornamented with long, yellowish setae; posterior margin of mesonotum slaty brown. Scutellum bluish slate, the apex sparsely ornamented with long, yellowish setae. Abdomen dark or reddish brown, rather thickly clothed with yellowish hairs. Legs brownish yellow.

Taken on red cedar at Poughkeepsie, N.Y. April 19, 1906.

Type Cecid. 1, N.Y. State Museum.

### Cecidomyia lobata n. sp.

**Male.** Length 1 mm. Antennae ½ longer than the body, sparsely haired, light brown, 14 segments. Face yellowish brown; mesonotum a variable reddish brown, lighter posteriorly, submedian lines yellowish. Scutellum yellowish, postscutellum and abdomen pale yellowish brown. Legs pale brown, tarsi slightly darker.

Taken on white clover at Karner, N.Y. June 4, 1906.

Type Cecid. 132 N.Y. State Museum.

### Cecidomyia urticae n. sp.

**Male.** Length 1.25 mm. Antennae ½ longer than the body, rather thickly clothed with fine hairs, pale brown, 14 segments. Face pale yellowish; mesonotum dark reddish brown with distinct submedian yellowish lines, posterior median area yellowish. Scutellum yellowish with sparse apical setae, postscutellum yellowish. Abdomen pale yellow with an irregular, reddish spot on the 2d and 3d abdominal segments. Legs a nearly uniform pale fuscous straw color.

Taken on nettle at Albany, N.Y. June 4, 1906.

Type Cecid. 123, N.Y. State Museum.

### Cecidomyia filicis n. sp.

**Male.** Length 1 mm. Antennae longer than the body, rather sparsely haired, dark brown, 14 segments. Mesonotum dark brown. Scutellum and postscutellum lighter. Abdomen yellowish brown, vestiture scarcely perceptible. Legs light brown, paler at the articulations.

Taken on ferns at Karner, N.Y. June 4, 1906.

Type Cecid. 139, N.Y. State Museum.

### Cecidomyia acerina n. sp.

**Male.** Length 1 mm. Antennae twice the length of the body, thickly clothed with long hairs, dark brown, 14 segments. Face yellowish brown; mesonotum reddish brown, probably with lighter submedian lines. Scutellum reddish. Abdomen yellowish brown with a distinct fuscous spot dorsally on the second and third abdominal segments. Legs pale straw color basally, darker apically, specially the tarsi.

Taken on maple at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 149, N.Y. State Museum.

### Cecidomyia toxicodendri n. sp.

**Male.** Length .75 mm. Antennae about ½ longer than the body, thickly clothed with fine setae, light brown, 14 segments. Face fuscous yellowish; mesonotum reddish brown, submedian lines pale yellowish, sparsely ornamented with fine setae. Scutellum and pleurae fuscous yellow, postscutellum yellowish. Abdomen a nearly uniform fuscous brown, rather thickly clothed with fine setae. Coxae and femora pale yellowish, tibiae and tarsi pale brown, tarsi slightly darker.

Taken on poison ivy at Nassau, N.Y. June 14, 1906.

Type Cecid. 263, N.Y. State Museum.

### Cecidomyia flavoscuta n. sp.

**Male.** Length .75 mm. Antennae longer than the body, rather thickly haired, dark brown, 14 segments. Face reddish brown; mesonotum dark brown with distinct submedian lines of pale setae. Scutellum yellowish with numerous yellowish hairs apically, postscutellum yellowish. Abdomen dark brown. Legs mostly yellowish transparent with reddish tints at the extremities of femora, tibiae and tarsi.

Taken at Albany, N.Y. May 21, 1906.

Type Cecid. 76, N.Y. State Museum.

### Cecidomyia quercina n. sp.

**Male.** Length .5 mm. Antennae nearly as long as the body, thickly clothed with fine hairs, yellowish gray, 14 segments. Face pale yellowish; mesonotum dark brown, submedian lines yellowish, sparsely ornamented with fine setae. Scutellum pale yellowish, postscutellum yellowish brown. Abdomen pale orange with a large fuscous median spot basally. Legs pale straw color, the annulations variably marked with carmine, distal tarsal segments fuscous.

Taken on swamp white oak at Albany, N.Y. June 21, 1906.

Type Cecid. 342, N.Y. State Museum.

### Cecidomyia hicoriae n. sp.

**Male.** Length .75 mm. Antennae fully twice as long as the body, thickly clothed with fine hairs, light brown, 14 segments.

Face dark fuscous; mesonotum dark brown. Scutellum reddish brown, postscutellum darker. Abdomen pale yellowish with dark brown mesially on the basal segment. Legs a nearly uniform pale reddish straw color, tarsi slightly darker.

Taken on hickory at Nassau, N.Y. June 14, 1906.

Type Cecid. 261, N.Y. State Museum.

### Cecidomyia fraxini n. sp.

**Male.** Length 1 mm. Antennae nearly twice the length of the body, sparsely haired, light brown, 14 segments. Mesonotum nearly uniform dark brown, submedian lines yellowish. Scutellum yellowish laterally, dark orange apically, postscutellum a little darker. Abdomen dark reddish, slightly lighter dorsally on the second and third abdominal segments. Legs nearly uniform dark brown, lighter ventrally.

Taken on ash at Albany, N.Y. June 10, 1906.

Type Cecid. 179, N.Y. State Museum.

### Cecidomyia flavomarginata n. sp.

**Male.** Length .75 mm. Antennae ½ longer than the body, thickly haired, light brown, 14 segments. Mesonotum yellowish brown, the broad median area thickly clothed with yellowish hairs. Scutellum reddish, the postscutellum probably concolorous. Abdomen light brown, anterior segments margined posteriorly with yellowish, posterior segments reddish. Coxae yellowish transparent tinged with reddish apically, femora yellowish transparent, tibiae slightly darker, tarsi light brown.

Taken on clover at Albany, N.Y. June 1, 1906.

Type Cecid. 109, N.Y. State Museum.

### Cecidomyia triangularis n. sp.

**Male.** Length 1 mm. Antennae longer than the body, sparsely clothed with coarse hairs, brown, 14 segments. Face yellowish; mesonotum brownish yellow, submedian lines obscure. Scutellum reddish. Abdomen brownish yellow, ovipositor pale. Coxae white, femora brown above, paler beneath, tibiae a little paler than the femora, tarsi brown.

Taken on Solidago at Lebanon, N.Y. August 26, 1906.

Type Cecid. 763, N.Y. State Museum.

**Cecidomyia excavata** n. sp.

**Male.** Length .75 mm. Antennae longer than the body, rather thickly clothed with short, dark brown setae, pale straw color, 14 segments. Face yellowish white; mesonotum reddish brown with distinct submedian yellowish lines sparsely clothed with setae. Scutellum yellow, tipped with carmine, postscutellum yellow. Abdomen pale, reddish yellow with slightly fuscous areas dorsally on the second and third segments. Legs variably brown tinged with reddish, lighter ventrally, the anterior and mid tarsi distinctly darker than the posterior.

Taken on soft maple at Albany, N.Y. May 21, 1906.

Type Cecid. 65, N.Y. State Museum.

**Cecidomyia carolinae** n. sp.

**Male.** Length 1 mm. Antennae $\frac{1}{4}$ longer than the body, thickly haired, fuscous yellowish, lighter basally, 14 segments. Face fuscous yellowish; mesonotum dark brown, submedian lines indistinct. Scutellum black or very dark brown, postscutellum dark brown. Abdomen pale yellowish, basal segments dark brown or black dorsally, the terminal segments shaded with orange. Legs a variable light fuscous yellow basally, basal tarsal segments somewhat darker than the distal ones.

Bred October 5, 1906, from gall on Solidago canadensis taken at Asheville, N.C. September 17, 1906.

Type Cecid. a1636, N.Y. State Museum.

**Cecidomyia tsugae** n. sp.

**Male.** Length 1 mm. Antennae twice as long as the body, thickly clothed with fine hairs, light brown, yellowish basally, 14 segments. Face yellowish; mesonotum dark brown, lighter posteriorly, submedian lines yellowish. Scutellum yellowish apically, rather thickly clothed with fine hairs. Abdomen fuscous yellowish. Legs rather dark brown, ventral surface and base of femora paler.

Taken on hemlock at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 168b, N.Y. State Museum.

### Cecidomyia incisa n. sp.

**Male.** Length .75 mm. Antennae half as long as the body, rather thickly clothed with setae, light brown, 14 segments. Mesonotum dark brown; scutellum orange-brown, postscutellum darker. Abdomen orange-brown, somewhat darker dorsally on the 2d, 3d and 4th abdominal segments. Legs variable yellowish brown and dark brown; posterior coxae reddish, femora and tibiae light brown, slightly darker distally, tarsi rather dark brown.

Taken on soft maple at Albany, N.Y. May 21, 1906.

Type Cecid. 67, N.Y. State Museum.

### Cecidomyia subtruncata n. sp.

**Male.** Length 1 mm. Antennae ½ longer than the body, thickly haired, dark brown, fuscous yellowish basally, 14 segments. Face fuscous yellowish; mesonotum dark brown, submedian lines yellow, uniting posteriorly in a median yellowish area. Scutellum dark red, postscutellum yellowish. Abdomen dark red, the segments margined posteriorly with fuscous, sparsely clothed with pale setae. Coxae and basal portion of femora pale yellowish, remainder of femora, tibiae and basal segment of tarsi fuscous brown, the three distal segments yellowish, variably tinged with carmine.

Taken on goldenrod or Aster at Albany, N.Y. July 6, 1906.

Type Cecid. 506, N.Y. State Museum.

### Cecidomyia eupatorii n. sp.

**Male.** Length 1 mm. Antennae fully ½ longer than the body, thickly clothed with long hairs, light brown, 14 segments. Face yellowish; mesonotum light olive-brown, submedian lines sparsely clothed with pale yellowish setae. Scutellum pale yellowish, postscutellum dark brown. Abdomen yellowish orange, slightly darker posteriorly, basal segments irregularly fuscous. Legs mostly a variable fuscous yellow, the articulations and terminal tarsal segments lighter.

Bred September 12, 1906, from galls taken on Eupatorium ageratoides at South bay, Glen lake, Lake Champlain, August 21, 1906.

Type Cecid. a1280, N.Y. State Museum.

**Cecidomyia juniperina** n. sp.

**Male.** Length 1 mm. Antennae fully $\frac{1}{3}$ longer than the body, thickly haired, light brown, yellowish basally, 14 segments. Mesonotum dark brown, submedian lines sparsely haired. Scutellum yellowish orange, postscutellum fuscous reddish. Abdomen reddish salmon, the basal four segments dark red. Coxae and femora fuscous transparent, tibiae and tarsi fuscous brown, distal segments darker.

Taken at Nassau, N.Y. August 7, 1906.

Type Cecid. 746, N.Y. State Museum.

**Cecidomyia karnerensis** n. sp.

**Male.** Length .75 mm. Antennae $\frac{1}{2}$ longer than the body, thickly clothed with fine hairs, light brown, 14 segments. Mesonotum dark brown with a silvery luster. Scutellum reddish, postscutellum dark brown. Abdomen reddish yellow, sparsely ornamented with rather coarse hairs. Legs semitransparent, yellowish brown, tarsi variably reddish, light or dark brown.

Taken at Karner, N.Y. May 16, 1906.

Type Cecid. 27, N.Y. State Museum.

**Cecidomyia rugosa** n. sp.

**Male.** Length .75 mm. Antennae twice the length of the body, thickly haired, light brown, 14 segments. Mesonotum dark brown, submedian lines sparsely haired. Scutellum yellowish red apically, postscutellum dark brown. Abdomen reddish brown, thickly haired, basal segments darker. Legs nearly uniform light brown.

Bred August 9, 1906, from galls collected on Solidago at Albany, N.Y. July 15, 1906.

Type Cecid. 650c, N.Y. State Museum.

**Cecidomyia caryae** n. sp.

**Male.** Length 2.5 mm. Antennae $\frac{1}{4}$ longer than the body, sparsely haired, light brown, 14 segments. Mesonotum brown, yellowish at the apex. Scutellum reddish. Abdomen yellow, with the posterior margin of each segment and a short transverse an-

terior line laterally, dark brown. Legs yellow at the base, tibiae and tarsi brown.

Taken on hickory at Albany, N.Y. June 19, 1906.

Type Cecid. 331, N.Y. State Museum.

### Cecidomyia asteris n. sp.

**Male.** Length 1.25 mm. Antennae longer than the body, thickly haired, light brown, fuscous yellowish basally, 14 segments. Face fuscous yellowish; mesonotum dark brown, submedian lines distinct. Scutellum yellowish, reddish apically, postscutellum yellowish. Abdomen dull yellowish, reddish apically and with a fuscous basal spot. Legs fuscous straw.

Taken on aster at Albany, N.Y. June 17, 1906.

Type Cecid. 615, N.Y. State Museum.

### Cecidomyia coryli n. sp.

**Male.** Length 1.5 mm. Antennae a little longer than the body, rather thickly clothed with fine setae, light brown, 14 segments. Face sooty yellow; mesonotum dark brown, dark reddish laterally, submedian lines yellowish, ornamented with fine setae. Scutellum reddish basally, slightly fuscous apically, with sparse apical setae, postscutellum dark yellowish. Abdomen pale yellowish orange, sparsely clothed with fine yellowish hairs, each segment narrowly margined with fuscous posteriorly and with short, dark, transverse lines on each side just behind the middle. Coxae and basal portion of femora pale straw-yellow, the other parts of the legs nearly uniform sooty yellowish or brownish.

Taken on hazel at Albany, N.Y. June 11, 1906.

Type Cecid. 216, N.Y. State Museum.

### Cecidomyia rubroscuta n. sp.

**Male.** Length .75 mm. Antennae about twice the length of the body, thickly clothed with light brown hairs, yellowish brown, 14 segments. Face dark brown; mesonotum with the anterior median and posterior sublateral lobes dark brown, the intermediate spaces lighter. Scutellum reddish brown, postscutellum dark brown. Abdomen rather dark brown, sparsely clothed with yellowish hairs.

Legs slightly variable, pale straw color, femora somewhat darker apically.

Taken on ash at Albany, N.Y. June 1, 1906.

Type Cecid. 93, N.Y. State Museum.

### Cecidomyia acernea n. sp.

**Male.** Length 1.5 mm. Antennae $\frac{1}{4}$ longer than the body, rather thickly clothed with fine setae, light brown, yellowish basally, 14 segments. Face pale yellowish; mesonotum dark brown, submedian lines pale yellowish, sparsely ornamented with fine setae. Scutellum somewhat fuscous yellowish with sparse apical setae, postscutellum and abdomen pale orange, with the latter slightly tinged dorsally with fuscous and rather sparsely clothed with fine, whitish hairs. Legs nearly uniform pale straw, tarsi somewhat darker.

Taken on soft maple at Nassau, N.Y. June 14, 1906.

Type Cecid. 267, N.Y. State Museum.

### Cecidomyia cincta n. sp.

**Male.** Length 1 mm. Antennae a little longer than the body, rather thickly clothed with fine hairs, dark brown, 14 segments. Mesonotum nearly uniform dark brown. Scutellum dark reddish, postscutellum yellowish brown. Abdomen with the basal segments yellowish brown, the third and fourth black, fifth and sixth pale orange, terminal segments black. Legs nearly uniform pale straw.

Taken at Albany, N.Y. June 13, 1906.

Type Cecid. 285, N.Y. State Museum.

### Cecidomyia sylvestris n. sp.

**Male.** Length 1.25 mm. Antennae $\frac{1}{4}$ longer than the body, thickly haired, brown, 14 segments. Mesonotum a variable yellowish and brown, submedian lines indistinct. Scutellum and postscutellum yellowish. Abdomen dark carmine, a fuscous spot near the middle. Femora and tibiae pale fuscous distally, tarsi fuscous.

Taken at Davidson's River, N.C. September 26, 1906.

Type Cecid. a1630, N.Y. State Museum.

### Dirhiza caryae n. sp.

**Female.** Length 2.5 mm. Antennae extending to the base of the abdomen, sparsely haired, reddish brown, 14 segments.

Face reddish; mesonotum dark brown, yellowish red laterally, the posterior median area yellowish, submedian lines yellowish, rather indistinct with sparse yellow setae. Scutellum reddish; postscutellum brown, yellowish laterally. Abdomen yellowish with a series of nearly circular dark brown median spots on the 2d, 4th, 5th and 6th abdominal segments; ventral surface reddish brown. Legs pale yellowish, irregularly tinged with reddish.

Taken on hickory at Albany, N.Y. May 20, 1906.

Type Cecid. 58, N.Y. State Museum.

### Dirhiza hamata n. sp.

**Female.** Length 2.5 mm. Antennae extending to the base of the abdomen, rather thickly haired, dark reddish brown, 13 segments. Head dark brown or black; mesonotum black, shining, with a few scattered setae laterally. Scutellum and postscutellum dark brown. Abdomen dark brown, somewhat reddish at the sides. Legs black; tarsi with the 1st joint and basal $\frac{4}{5}$ of the 2d dark brown, the remainder white, the 3d and 4th segments white, 5th slightly infuscated.

Taken at Albany, N.Y. June 8, 1906.

Type Cecid. 142, N.Y. State Museum.

### Porricondyla ampelophila n. sp.

**Male.** Length 1.5 mm. Antennae a little shorter than the body, sparsely haired, dark brown, fuscous yellowish basally, 14 segments. Face fuscous yellowish; mesonotum nearly uniform dark brown. Scutellum dark reddish brown, postscutellum dark brown. Abdomen dark yellowish brown with yellowish on the dorsum of the fourth segment, sparsely clothed with dark hairs. Legs a pale fuscous yellowish, tarsi slightly darker.

Taken on Virginia creeper at Albany, N.Y. July 3, 1906.

Type Cecid. 450, N.Y. State Museum.

### Porricondyla pini n. sp.

**Male.** Length 1.5 mm. Antennae probably longer than the body, rather thickly clothed with coarse hairs, light brown, 15 segments. Face pale yellowish; mesonotum dark brown, submedian lines with yellowish hairs. Scutellum pale orange with sparse apical setae; postscutellum slightly darker; abdomen rather dark

brown. Genitalia pale orange and rather thickly clothed with yellowish hairs. Legs a nearly uniform pale straw color.

Taken on white pine at Albany, N.Y. June 10, 1906.

Type Cecid. 221, N.Y. State Museum.

### Porricondyla pinea n. sp.

**Male.** Length 2 mm. Antennae longer than the body, sparsely haired, yellowish brown, basally yellowish, 15 or 16 segments. Mesonotum light brown, yellowish posteriorly, submedian lines broad, yellowish, scutellum light reddish, postscutellum yellowish. Abdomen pale salmon, the color slightly deeper on the basal and antipenultimate segments. Genitalia fuscous yellowish; legs a nearly uniform light fuscous yellowish.

Taken at Davidson's River, N.C. September 24, 1906.

Type Cecid. a1622, N.Y. State Museum,

### Porricondyla carolinae n. sp.

**Male.** Length 1.3 mm. Antennae ½ longer than the body, sparsely haired, yellowish brown, yellowish basally, 16 segments. Face yellowish; mesonotum fuscous yellowish, submedian lines yellowish, the area between the submedian lines distinctly lighter than the sublateral areas. Scutellum reddish brown, postscutellum yellowish; abdomen fuscous yellow. Genitalia slightly fuscous; legs a nearly uniform yellowish fuscous.

Taken at Davidson's River, N.C. September 26, 1906.

Type Cecid. a1624, N.Y. State Museum.

### Porricondyla trifolii n. sp.

**Male.** Length .75 mm. Antennae almost three times as long as the body, sparsely haired, dark brown, at least 14 and probably 16 segments. Face fuscous; mesonotum dark brown, submedian lines indistinct; scutellum pale orange; postscutellum and abdomen dark brown. Genitalia slightly fuscous, sparsely clothed with yellowish hairs. Legs a nearly uniform dark brown.

Taken on white clover at Albany, N.Y. July 3, 1906.

Type Cecid. 455, N.Y. State Museum.

### Porricondyla diervillae n. sp.

**Male.** Length 1 mm. Antennae ½ longer than the body, sparsely haired, dark brown, yellowish basally, 16 segments. Face yel-

lowish; mesonotum reddish, submedian lines yellow. Scutellum, postscutellum and abdomen pale yellowish. Legs a nearly uniform dark brown.

Taken on bush honeysuckle at Karner, N.Y. July 5, 1906.

Type Cecid. 485, N.Y. State Museum.

### Porricondyla hamata n. sp.

**Male.** Length 3 mm. Antennae ¼ longer than the body, sparsely clothed with long hairs, fuscous yellowish, probably 16 segments. Face yellowish, the mouth parts carmine; mesonotum dark brown, submedian lines narrow, yellowish. Scutellum pale yellowish, postscutellum yellowish; abdomen fuscous yellow, the segments margined posteriorly with fuscous. Genitalia light fuscous. Legs fuscous yellowish, the last tarsal segments of the 1st and 2d pair of legs and the 2 distal segments of the 3d pair of legs yellowish.

Taken at Davidson's River, N.C. September 26, 1906.

Type Cecid. a1626, N.Y. State Museum.

### Porricondyla flava n. sp.

**Male.** Length 1 mm. Antennae a little longer than the body, sparsely haired, dark brown, at least 12 and probably 14 or more segments. Face pale yellowish; mesonotum pale brownish apically, yellowish posteriorly. Scutellum, postscutellum and abdomen light yellowish. Legs a nearly uniform pale straw color.

Taken on soft maple at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 151, N.Y. State Museum.

### Porricondyla graminis n. sp.

**Female.** Length 1 mm. Antennae about as long as the body, sparsely haired, dark brown, 12 segments. Mesonotum dark brown; scutellum deep carmine; postscutellum reddish. Abdomen reddish brown, lighter distally. Legs a nearly uniform pale brown.

Taken on quack grass at Albany, N.Y. July 14, 1906.

Type Cecid. 570, N. Y. State Museum.

### Porricondyla sylvestris n. sp.

**Female.** Length 1 mm. Antennae extending to the middle of the abdomen, sparsely haired, dark brown, 12 segments. Mesonotum dark brown, submedian lines yellowish. Scutellum and post-

scutellum dark brown; abdomen yellowish; legs a nearly uniform pale straw color.

Taken on low plants in balsam woods at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 175, N. Y. State Museum.

### **Porricondyla quercina** n. sp.

**Female.** Length 1.5 mm. Antennae as long as the body, rather thickly clothed with coarse hairs, dark brown, 12 segments. Face fuscous; mesonotum dark brown with the sublateral and median posterior areas yellow. Scutellum pale reddish, postscutellum yellow. Abdomen dark brown; coxae and base of femora yellowish, distal portion of femora yellowish brown; tibiae and tarsi dark brown.

Taken on scrub oak at Karner, N.Y. May 19, 1906.

Type Cecid. 62, N.Y. State Museum.

### **Porricondyla altifila** n. sp.

**Female.** Length 1.25 mm. Antennae as long as the body, sparsely haired, fuscous, 12 segments. Mesonotum and scutellum reddish yellow, the latter with a fuscous line at the apex; postscutellum and abdomen yellowish. Legs with the anterior ones fuscous at the base; tarsi paler, posterior legs pale.

Taken on skunk cabbage at Karner, N.Y. June 26, 1906.

Type Cecid. 398, N.Y. State Museum.

### **Porricondyla borealis** n. sp.

**Female.** Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, dark brown, yellowish basally, 14 segments. Face yellowish; mesonotum reddish brown, submedian lines yellowish; scutellum yellowish apically, postscutellum and abdomen dark reddish brown. Legs a nearly uniform dark brown; tibiae and tarsi slightly darker.

Taken on spruce at Lake Clear, N.Y. June 7, 1906.

Type Cecid. 155, N.Y. State Museum.

### **Asynapta cerasi** n. sp.

**Male.** Length 1.5 mm. Antennae about as long as the body, rather thickly clothed with whitish hairs, light brown, yellowish

basally, 23 segments. Face pale yellowish; mesonotum rather dark brown, the posterior median area yellowish, submedian lines narrow, distinctly yellowish, irregularly margined with coarse setae; scutellum pale orange-yellow with sparse apical setae; postscutellum concolorous. Abdomen somewhat variably orange yellowish; genitalia slightly fuscous; legs a rather dark straw-brown, lighter ventrally.

Taken on cherry at Albany, N.Y. June 12, 1906.

Type Cecid. 236, N.Y. State Museum.

### **Asynapta photophila** n. sp.

**Male.** Length 2 mm. Antennae $\frac{1}{4}$ longer than the body, sparsely haired, light brown annulate with yellow, 28 segments. Face yellowish; mesonotum reddish brown with distinct lighter submedian lines ornamented with yellowish hairs; posterior median area yellowish. Scutellum reddish brown with sparse apical hairs; postscutellum and abdomen a slightly variable reddish brown. Legs long, a nearly uniform pale straw color.

Taken in trap lantern at Nassau, N.Y. June 3, 1906.

Type Cecid. 119, N.Y. State Museum.

### **Winnertzia furcata** n. sp.

**Male.** Length 2 mm. Antennae as long as the body, sparsely clothed with whorls of long hairs, fuscous, 16 segments. Head testaceous; mesonotum dark brown, sparsely clothed with long hairs. Scutellum and postscutellum testaceous; abdomen testaceous with the lateral margins darker and sparsely clothed with short pale hairs. Legs testaceous at base, becoming dark brown at the top, the 2 basal tarsal segments of the anterior legs brown, the others yellow. The basal and most of the second tarsal segment of the posterior legs brown, the tip of the 2d and the other remaining segments white; articulations pale straw.

Taken at Nassau, N.Y. June 21, 1906.

Type Cecid. 336, N.Y. State Museum.

### **Winnertzia carpini** n. sp.

**Male.** Length 1 mm. Antennae about as long as the body, thickly haired, dark brown, 13 segments. Mesonotum yellowish brown, rather thickly clothed along the broad median area with fine

yellowish hairs. Scutellum yellowish with sparse apical hairs, postscutellum a little darker. Abdomen yellowish brown, the basal segments and genitalia darker. Coxae and femora yellowish transparent, the latter slightly fuscous apically. Tibiae and tarsi pale yellowish brown.

Taken on ironwood or blue beech at Albany, N.Y. June 1, 1906.

Type Cecid. 106, N.Y. State Museum.

### **Winnertzia solidaginis** n. sp.

**Male.** Length .75 mm. Antennae probably as long as the body, sparsely haired, dark brown, probably at least 14 segments. Mesonotum dark brown, submedian lines with sparse setae; scutellum fuscous brown, yellowish apically, postscutellum and abdomen dark brown. Legs a nearly uniform pale yellowish; tarsi variably tinged with pale orange.

Taken on goldenrod or aster at Albany, N.Y. July 6, 1906.

Type Cecid. 508, N. Y. State Museum.

## ADDENDA

### **Campylomyza dilatata** n. sp.

**Male.** Length 1.5 mm. Antennae nearly as long as the body, sparsely haired, fuscous yellowish, 14 segments; face fuscous yellowish, eyes large, black. Mesonotum dark brown. Scutellum yellowish, postscutellum fuscous yellowish. Abdomen a variable fuscous yellowish. Legs a nearly uniform light fuscous yellowish. Easily recognized by the short, stout, greatly dilated subtriangular terminal clasp segment.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, light fuscous yellowish, 13 segments. Color characters about as in the opposite sex.

Bred by Dr M. T. Thompson of Clark University, Worcester, Mass., from earth containing seeds and vegetable debris.

Type Cecid. 1109, N. Y. State Museum.

### **Lasioptera convolvuli** n. sp.

**Male.** Length 2.25 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, fuscous yellowish basally, 17 segments; face rather thickly clothed with silvery white scales. Mesonotum dark brown, rather thickly and evenly clothed

with yellowish white scales. Scutellum reddish brown with a few coarse setae apically, postscutellum darker. Abdomen a rich dark brown, the first segment rather broadly banded posteriorly with silvery white, the others with submedian rows of small, lunate, silvery white spots and sublateral rows of rather prolonged, silvery white spots, particularly on the second, third and fourth segments, venter suffused with silvery white, genitalia fuscous. Halteres a nearly uniform yellowish orange. Legs mostly a dark brown, the basal half of femora, the femoro-tibio articulation, the extremity of the tibiae and narrow basal annûlations on the tarsal segments yellowish white, the bands wider on the posterior legs.

**Female.** Length 2.5 mm. Antennae with 20 segments. Mesonotum dark brown, sparsely margined laterally and anteriorly with rather long, yellowish hairs, the submedian lines rather thickly ornamented posteriorly with yellowish hairs. Other markings about as in the opposite sex.

Bred from a fusiform stem gall on hedge bind-weed, Convolvulus sepium, May 14, 1907.

Type Cecid. a1465, N. Y. State Museum.

### Lasioptera cylindrigallae n. sp.

**Male.** Length 2 mm. Antennae extending to the base of the abdomen, dark brown, sparsely haired, 15 or 16 segments; face with a conspicuous patch of silvery white scales, the eyes distinctly margined posteriorly with a rather broad band of silvery white scales. Mesonotum dark brown, variably margined laterally and anteriorly with silvery white and yellowish scales, the submedian lines rather sparsely clothed with golden yellow hairs, the median and sublateral areas rather uniformly clothed with short, golden yellow hairs. Scutellum dark brown with numerous yellowish setae apically, postscutellum dark brown. Abdomen dark brown with large, submedian rows of lunate, silvery white spots, the latter on the posterior margins of the segments and extending to the lateral line; genitalia dull yellowish, slightly fuscous apically, venter suffused with silvery white scales. Halteres a nearly uniform pale yellowish. Legs with coxae mostly fuscous, the base of femora yellowish white, the distal portion of tibiae and tarsi dark brown, the latter darker.

**Female.** Length 2.5 mm. Antennae with 21 to 22 segments. Color characters about as in the opposite sex.

Bred from a uniform enlargement of the upper portions of solidago stems, the gall being 10 cm long by .7 cm in diameter and occurring usually just below the point where the branches arise. Taken at Staten Island April 2, 1907. Adults bred May 6.

Type Cecid. a1408, N. Y. State Museum.

### Lasioptera humulicaulis n. sp.

**Male.** Length 2 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, basal segments fuscous yellowish, 21 segments; face sparsely clothed with whitish scales, eyes small, narrowly margined posteriorly with silvery white. Mesonotum dark brown, the submedian lines thickly clothed with long, golden yellow scales; laterally there is a narrow margin of yellowish and silvery white scales, the general surface rather thickly clothed with fine, yellowish scales. Scutellum dark brown with rather numerous yellowish setae apically, postscutellum pale orange. Abdomen dark brown with submedian rows of rather large, lunate, silvery white spots, the markings on the posterior margins of segments one to six, the seventh segment and genitalia yellowish orange. Halteres semitransparent basally, pale orange distally. Legs with coxae and basal portion of femora pale yellowish, the remainder dark brown.

**Female.** Length 3 mm. Antennae extending to the second abdominal segment, thickly haired, dark brown, the basal segments yellowish, 25 segments. Color characters nearly as in the opposite sex.

Bred May 2, 1907 from a long stem gall on hop. This is a uniform swelling some 50 cm in length, about 1 cm in diameter and with a hollow, blackened interior inhabited by numerous larvae. Taken by Henry Bird at Rye, N. Y., April 17, 1907.

Type Cecid. a1446, N. Y. State Museum.

### Lasioptera lactucae n. sp.

**Female.** Length 1.5 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, dark brown, 19 segments. Mesonotum thickly clothed with bronzy scales. Scutellum yellowish with a few apical setae, postscutellum apparently dark brown. Abdomen dark brown or black, with submedian rows of lunate, silvery white marks on the posterior margins of the segments.

Ovipositor yellowish. Legs fuscous yellowish, the tarsi brown, the distal tarsal segments darker.

**Male.** Length 2 mm. Antennae with 17 segments. Color characters presumably nearly as in the opposite sex.

Bred by Dr M. T. Thompson of Clark University, Worcester, Mass. f om tumor gall on the top of wild lettuce stalks.

Type Cecid. 1102, N. Y. State Museum.

### **Lasioptera lycopi** n. sp.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 18 segments; face with a conspicuous patch of yellowish white scales, the black eyes margined posteriorly with silvery white, especially laterally. Mesonotum shining black, sparsely margined laterally with silvery white scales, the submedian lines faintly indicated by a few hairs. Scutellum a deep reddish brown, postscutellum dark brown. Abdomen a rich brownish black with a submedian row of small, lunate, silvery white spots, the latter on the posterior margins of the segments; laterally there is a row of irregular, silvery white spots slightly produced anteriorly and resting on the posterior margin of each segment; venter dark brown with the median line, the posterior and anterior margins of the segments clothed with silvery white scales. Halteres a pale yellowish salmon, the coxae and base of femora a pale yellowish, distal portion of femora, tibiae and tarsi dark brown, the articulations marked by narrow, white annulations, the latter broader on the posterior tarsi.

Bred May 17, 1907 from an oval, fusiform stem gall on bugleweed, Lycopus communis.

Type Cecid. a1348, N. Y. State Museum.

### **Lasioptera rosea** n. sp.

**Female.** Length 2 mm. Antennae extending to the second abdominal segment, sparsely haired, dark brown, 22 segments; face rather thickly clothed with whitish scales. Mesonotum dark brown, rather thickly bordered laterally and anteriorly with golden yellow scales, submedian lines thickly clothed with similar scales. Scutellum brownish black, yellowish apically, postscutellum dark brown. Abdomen a dark brown or black, the segments narrowly margined posteriorly with silvery white; ovipositor pale orange, venter irregularly suffused with silvery white scales. Halteres a

pale yellowish orange. Legs a nearly uniform dark brown or black, the posterior pair with very narrow, white annulations at the base of the first tarsal segment.

Bred May 16, 1907 from an oval blister gall on the young leaves of Solidago rugosa.

Type Cecid. a1474, N. Y. State Museum.

### **Lasioptera vitinea** n. sp.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, the basal segments yellowish, 23 segments. Mesonotum dark brown, variably white margined anteriorly and laterally. Scutellum reddish brown, postscutellum yellowish. Abdomen a dark brown, the basal segment thickly clothed with silvery white scales, the second to sixth segments narrowly margined posteriorly with silvery white scales; a crenulate white line laterally. Ovipositor pale yellowish. Halteres pale yellow basally, yellowish white apically. Coxae and femora fuscous yellowish, tibiae light brown, tarsi dark brown.

Bred June 15, 1907, from a leaf petiole gall on grape, taken on Staten Island, N. Y.

Type Cecid. a1415, N. Y. State Museum.

### **Choristoneura albitarsis** n. sp.

**Male.** Length 2.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, yellowish basally, 20 segments. Mesonotum a shining dark brown. Scutellum and postscutellum dark brown. Abdomen evidently badly denuded, a deep salmon with numerous dark brown or black scales dorsally. Halteres yellowish transparent, tarsi dark brown, the segments annulate basally with silvery white.

**Female.** Length 3 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, fuscous yellowish basally, 24 to 25 segments, eyes narrowly margined posteriorly with silvery white. Mesonotum dark brown or black, broadly margined laterally and anteriorly with silvery white, submedian lines rather thickly clothed with yellowish scales. Scutellum dark brown, thickly clothed apically with whitish scales, postscutellum dark brown. Abdomen dark brown or black, with submedian rows of lunate, silvery white spots. Halteres pale orange basally, light yellowish apically. Legs mostly a dark brown, the articulations

narrowly annulate with silvery white, those on the posterior tarsi broad, the most of the fourth and fifth segments yellowish white.

Bred May 18, 1907 from a stem gall much resembling that of Lasioptera desmodii Felt and taken in open woods at Nassau, N. Y.

Type Cecid. a1477, N. Y. State Museum.

### Choristoneura eupatorii n. sp.

**Male.** Length 1.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, the basal segments sparsely clothed with silvery scales ventrally, 17 segments; eyes black, margined posteriorly with silvery white. Mesonotum dark brown or black, the submedian lines sparsely clothed with fine hairs. Scutellum dark brown, postscutellum yellowish or fuscous brown. Abdomen dark brown with submedian rows of small, lunate, silvery white spots, the markings being on the posterior margin of the first to sixth segments, the terminal segments fuscous yellowish, the venter suffused with silvery white scales. Halteres pale yellowish. Legs dark brown, the first tarsal segment and narrow basal annulations on the second to fifth, white.

**Female.** Length 2.5 mm. Antennae with 23 segments. The other color characters about as in the opposite sex.

Bred May 2, 1907 from an oval or subglobular swelling on the stem of presumably Eupatorium ageratoides, thickly packed with numerous Cecidomyid larvae in closely webbed cocoons. Rather rare on Staten Island.

Type Cecid. a1413, N. Y. State Museum.

### Choristoneura flavolunata n. sp.

**Female.** Length 2.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark reddish brown, 21 segments; face reddish brown, sparsely clothed with whitish scales, mouth parts fuscous apically. Mesonotum dark brown, almost black, the base of the wing insertions reddish. Scutellum dark brown, with a few yellowish setae apically, postscutellum and abdomen dark brown, almost black, the incisures of the latter dusky reddish, the dorsum of the eighth segment and the ovipositor fuscous yellowish; laterally, though hardly ventrally there is a broken band of five somewhat conspicuous subquadrate patches of silvery white

scales, the venter sparsely clothed with silvery white scales. Legs a nearly uniform black.

Bred from several oval, yellowish, marginal, blister galls on solidago.

Type Cecid. a1430, N. Y. State Museum.

### Choristoneura hamata n. sp.

**Male.** Length 3 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 18 segments; face fuscous with a few whitish scales; head rather thickly clothed with pale yellowish scales posteriorly. Mesonotum dark brown, sparsely margined laterally and anteriorly with yellowish hairs, submedian lines rather thickly clothed with the same. Scutellum dark brown with a few whitish scales, postscutellum dark brown. Abdomen dark brown or black with submedian rows of conspicuous lunate, silvery white spots. Genitalia, fuscous yellowish. Halteres pale yellowish. Legs a variable brown, the tarsi dark brown.

**Female.** Length 2.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 20 to 22 segments. Other color characters about as in the opposite sex.

Bred April 28 and May 18, 1907 from an oval gall on the stem of an unknown weed taken at Albany, N. Y. This enlargement somewhat resembles that made by Lasioptera desmodii Felt.

Type Cecid. a1458, N. Y. State Museum.

### Choristoneura hibisci n. sp.

**Male.** Length 1.75 mm. Antennae hardly extending to the base of the abdomen, thickly haired, dark brown, 16 segments; face fuscous with a conspicuous patch of silvery white scales, the black eyes narrowly margined posteriorly with silvery white. Mesonotum dark brown, narrowly and irregularly margined laterally with golden yellow scales, the submedian lines rather thickly clothed with golden yellow hairs. Scutellum dark brown, sparsely ornamented with silvery white scales and with a few long setae apically, postscutellum dark brown. Abdomen dark brown or black, with submedian rows of somewhat irregular, sublunate, silvery white spots. Halteres pale salmon basally, whitish transparent apically. Legs mostly dark brown, the articulations annulate with white, the bands broader on the posterior tarsi.

**Female.** Length 2.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, the basal segments fuscous yellowish, 23 segments; eyes narrowly margined posteriorly with silvery white. Mesonotum a rich dark brown, the anterior lateral angles narrowly margined with silvery white, the submedian lines sparsely clothed with light golden yellow scales and with broad, submedian, golden vittae anteriorly. Scutellum dark brown or black, rather thickly clothed with silvery white scales, postscutellum dark brown. Abdomen a rich dark brown, with submedian rows of silvery white, transverse, lunate spots on segments one to seven posteriorly; in addition there is a series of longitudinal, lunate spots just above the stigmatal line. Ovipositor pale yellowish, the venter suffused with silvery white scales, except the rather indistinct, yellowish submedian lines. The white scales on the under surface are prolonged laterally and on the margins of the segments, and form a series of triangular marks. Halteres pale yellowish basally and apically, pale salmon subapically. Legs with the femora and coxae basally variably yellowish, the other portions of the legs dark brown, except the base of the tibia and the first tarsal segment, which are narrowly annulate with yellowish white; otherwise the anterior and mid tarsi are nearly uniform brownish black, the posterior tarsi with the extremities of the second tarsal segment narrowly, and those of the others broadly annulate, except the distal end of the fifth segment, with silvery white.

Bred April 25, 1907 from slightly enlarged stems of the rose marsh mallow, Hibiscus moscheutos, taken on Staten Island, N. Y.

Type Cecid. a1410, N. Y. State Museum.

## **Choristoneura perfoliata** n. sp.

**Male.** Length 2 mm. Antennae very short, sparsely haired, dark brown, 18 segments. Mesonotum dark brown, the submedian lines rather thickly clothed with yellowish setae. Scutellum yellowish brown with a few sparse setae apically, postscutellum fuscous yellowish. Abdomen dark brown, the segments narrowly margined posteriorly with silvery white, the eighth mostly pale yellowish, genitalia fuscous. Legs dark brown, the anterior and mid tarsi narrowly, and the posterior tarsi broadly banded with cinereous.

**Female.** Length 2 mm. Antennae extending to the base of the abdomen, 24 segments. Color characters nearly as in the opposite sex.

Bred by Dr M. T. Thompson of Clark University, Worcester, Mass. from an oval stem gall on Eupatorium perfoliatum.

Type Cecid. 1101, N. Y. State Museum.

### Dasyneura canadensis n. sp.

**Male.** Length 2 mm. Antennae nearly as long as the body, sparsely haired, dark brown, a few of the terminal segments reddish, the basal segments and mouth parts fuscous yellowish, 17 segments; eyes broadly margined posteriorly with fine, yellowish hairs. Mesonotum reddish brown, sometimes darker, submedian lines narrow, rather thickly clothed with fine hairs. Scutellum pale yellowish red with a few coarse setae apically, postscutellum and abdomen pale salmon, the latter sparsely clothed with fine hairs; genitalia fuscous. Halteres and basal portion of femora pale yellowish, distal portion of femora and tibiae fuscous yellowish, the tarsi a variable fuscous brown.

**Female.** Length 2 mm. Antennae extending to the third abdominal segment, sparsely haired, dark brown, slightly reddish distally, the basal segments fuscous yellowish, 13 segments. Other characters about as in the opposite sex.

Bred May 1, 1907 from Cecidomyid larvae infesting the seeds of the white spruce, Abies alba. Taken by Dr James Fletcher in the vicinity of Ottawa, Canada in April 1907.

Type Cecid. a1428, N. Y. State Museum.

### Dasyneura flavotibialis n. sp.

**Male.** Length 1.25 mm. Antennae nearly as long as the body, thickly clothed with whorls of long hairs, fuscous yellowish, 11 segments; face fuscous yellowish. Mesonotum a fuscous greenish yellow, the submedian lines rather thickly clothed with long, fuscous hairs. Scutellum a light reddish yellow with long setae apically, postscutellum yellowish. Abdomen dark yellowish red, thickly clothed with dark brown scales and with the segments margined posteriorly with long, dark brown setae, the seventh segment and genitalia fuscous yellowish, venter yellowish red, rather thickly clothed with dark brown scales, except for a narrow

median line; pleurae and coxae yellowish transparent, the latter with the anterior pair of legs rather thickly clothed with long, black setae; femora mostly dark brown or black, yellowish basally; tibiae a nearly uniform yellowish, tarsi fuscous yellowish, the three distal segments black.

**Female.** Length 2 mm. Antennae extending to the second abdominal segment, sparsely haired, fuscous yellowish, 10 segments. Other characters about as in the opposite sex, except that the tibiae have the distal half fuscous yellowish, darker apically.

Adults bred May 7 and 8 from decaying wood infested by fungus and covered by moss. Taken at Nassau, N. Y.

Type Cecid. a1454, N. Y. State Museum.

### Asphondylia sobrina n. sp.

**Male.** Length 3 mm. Antennae extending to the second abdominal segment, sparsely haired, light yellowish, 14 segments; face fuscous yellowish, eyes large, black. Mesonotum dark brown, the submedian lines rather thickly clothed with yellowish hairs. Scutellum reddish yellow, postscutellum yellowish. Abdomen reddish brown, genitalia yellowish, fuscous distally. Halteres semitransparent basally and apically, fuscous yellowish subapically. Legs a variable light fuscous yellowish.

**Female.** Length 3.5 mm. Face yellowish. Mesonotum a light fuscous orange, the submedian lines lighter. Scutellum pale yellow, postscutellum yellowish. Abdomen pale orange, the distal segments lighter. Other characters about as in the opposite sex.

Collected and bred by Dr M. T. Thompson of Clark University, Worcester, Mass. from earth containing elm keys and vegetable debris.

Type Cecid. 1108, N. Y. State Museum.

### Rhopalomyia arcuata n. sp.

**Male.** Length 2 mm. Antennae probably as long as the body, sparsely haired, pale straw color and with at least 15 segments; face dark brown. Mesonotum nearly uniform dark brown, the submedian lines sparsely ornamented with fuscous hairs. Scutellum yellowish brown with sparse hairs apically, postscutellum orange brown. Abdomen dark brown, rather thickly clothed with fuscous hairs. Halteres yellowish transparent basally, fuscous apically, coxae fuscous yellowish, rather thickly clothed with fuscous hairs.

Legs nearly uniform pale straw, the femora rather sparsely clothed with fuscous hairs.

Swept from solidago or sweetfern at Albany, N.Y., June 4, 1906.

Type Cecid. 124, N. Y. State Museum.

### Rhopalomyia astericaulis n. sp.

**Male.** Length 2.5 mm. Antennae probably extending to the fourth abdominal segment, sparsely haired, dark brown, 18 segments. Mesonotum reddish brown, darker laterally, the submedian lines rather thickly clothed with long hairs. Scutellum fuscous yellowish, postscutellum yellowish. Abdomen reddish brown with the segments margined posteriorly with long hairs. Halteres whitish transparent basally, fuscous apically. Legs a somewhat variable dark brown.

Collected and bred by Dr M. T. Thompson of Clark University, Worcester, Mass. from an oval twig gall on aster. Probably an inquiline with Choristoneura ramuscula Beutm.

Type Cecid. 1107a, N. Y. State Museum.

### Rhopalomyia thompsoni n. sp.

**Male.** Length 2.5 mm. Antennae nearly as long as the body, sparsely haired, pale yellowish, the basal and distal segments tinged with reddish; 19 segments. Mesonotum dark reddish, the submedian lines sparsely clothed with fine setae. Scutellum pale salmon, postscutellum dark brown. Abdomen a deep brick-red with heavy bands of black scales, genitalia fuscous. Halteres yellowish transparent. Legs mostly black, the coxae and base of femora a variable yellowish.

**Female.** Length 4 mm. Color characters nearly as in the opposite sex.

Collected and bred by Dr M. T. Thompson of Clark University, Worcester, Mass. from a globular or ovoid, fleshy gall on the rootstock of Solidago rugosa.

Type Cecid. 1100, N. Y. State Museum.

### Oligotrophus asplenifolia n. sp.

**Male.** Length 2 mm. Antennae nearly as long as the body, sparsely haired, light fuscous yellowish, 15 segments. Mesonotum dark brown, the narrow submedian lines and posterior median area yellowish. Scutellum and postscutellum fuscous yellowish. Abdomen a deep orange yellow, the distal segments paler, the incisures

and pleurae pale salmon, genitalia fuscous yellowish. Halteres yellowish transparent. Legs pale yellowish, the femora dorsally blackish, tibiae and tarsi progressively fuscous apically.

**Female.** Length 1.75 mm. Antennae with presumably 15 segments, other characters about as in the male.

Collected and reared by Dr M. T. Thompson of Clark University, Worcester, Mass. from a fleshy fold or lamina near the midvein on leaves of sweet fern.

Type Cecid. 1103, N. Y. State Museum.

### **Hormomyia crataegifolia** n. sp.

**Male.** Length 4 mm. Antennae a little longer than the body, sparsely haired, reddish brown, 14 segments. Mesonotum dark brown, the submedian lines sparsely clothed with whitish hairs, a few scattered hairs on the lateral borders. Scutellum dark brown, with a few whitish hairs on each side, postscutellum slightly darker. Abdomen dark red, pleurae darker. Halteres and coxae yellowish red, the remainder of the legs a little paler, with the tarsi somewhat whitish.

**Female.** Length 4 mm. Antennae extending to the fourth abdominal segment, yellowish red or reddish, sparsely haired, 14 segments. Colorational characters about as in the opposite sex.

Bred from whitish, oval cocoons adhering to Crataegus leaves. Larvae taken from the cockscomb gall on Crataegus.

Type Cecid. a1362, N. Y. State Museum.

### **Hormomyia needhami** n. sp.

**Male.** Length 6 mm. Antennae extending to the fourth abdominal segment, finely haired, pale fuscous yell wish, the stems semitransparent, 26 segments; face fuscous. Mesonotum yellowish, the anterior and lateral margins bordered by fuscous, the latter slightly produced on the median line. Scutellum and postscutellum pale yellowish, the latter dark brown posteriorly. Abdomen fuscous yellowish, sparsely clothed with fine hairs. Halteres fuscous yellowish. Legs a variable fuscous yellowish.

Taken by Dr James G. Needham at Lake Forest, Ill., June 6, 1906.

Type Cecid. 788, N. Y. State Museum.

### **Hormomyia truncata** n. sp.

**Male.** Length 3 mm. Antennae nearly as long as the body, thickly haired, pale yellowish, 23 segments; mouth parts fuscous

yellowish. Mesonotum a nearly uniform dark reddish brown, the submedian lines indistinct. Scutellum yellowish red, postscutellum slightly yellowish basally, reddish yellow distally. Abdomen rather thickly clothed with long, fuscous hairs, reddish yellow, the genitalia dark orange. Halteres yellowish basally, fuscous apically. Legs a variable dark brown and reddish yellow, the distal tarsal segments mostly reddish yellow.

Taken by Mr J. G. Jack, near Boston, Mass.

Type Cecid. 817, N. Y. State Museum.

### Contarinia consobrina n. sp.

**Male.** Length 1.5 mm. Antennae longer than the body, thickly haired, pale yellowish or reddish, 14 segments; face yellowish. Mesonotum dark brown. Scutellum reddish, post scutellum fuscous mesially, yellowish laterally. Abdomen yellowish red, fuscous laterally. Coxae, femora and tibiae pale yellowish, tarsi yellowish or variably suffused with carmine.

Taken at Karner, N. Y., May 16, 1906 on fern.

Type Cecid. 61, N. Y. State Museum.

### Contarinia tiliae n. sp.

**Male.** Length 1.5 mm. Antennae a little longer than the body, rather thickly haired, light brown, 14 segments. Mesonotum dark brown. Scutellum an orange brown. Abdomen light brown. Halteres yellow and reddish transparent. Legs mostly yellowish transparent, extremities of tibiae and tarsi with a distinct reddish cast.

Taken at Karner, N. Y., May 16, 1906 on basswood.

Type Cecid. 25, N. Y. State Museum.

### Winnertzia calciequina n. sp.

**Male.** Length 2 mm. Antennae a little shorter than the body, thickly haired, dark brown, yellowish basally, 14 segments; face greenish yellow. Mesonotum dark brown, sparsely clothed with fine, silvery hairs. Scutellum and postscutellum dark brown. Abdomen yellowish green basally, the apical segments light brown. Halteres whitish transparent. Coxae, femora and tibiae mostly pale yellowish, tarsi nearly uniform fuscous.

Taken at Albany, N. Y. July 16, 1906 on pine.

Type Cecid. 561, N. Y. State Museum.

### Lasioptera caulicola n. sp.

**Female.** Length 2 mm. Antennae very short, sparsely haired, dark brown, 23 segments; face sparsely clothed with silvery white scales. Mesonotum dark brown, rather broadly margined laterally and anteriorly with silvery white, the submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum a little darker. Abdomen dark brown, the basal segments silvery white dorsally, the third and fourth segments rather broadly margined along the median third posteriorly with silvery white, the second segment with an elongate median white dot on the posterior margin, ovipositor pale yellowish. Halteres pale yellowish, apically a light salmon. Coxae fuscous basally, yellowish apically, femora and tibiae dark brown, irregularly and broadly banded at the extremities with silvery white, tarsi dark brown.

Bred June 3, 1907 from apparently normal stems of bush-honeysuckle.

Type Cecid. a1469a, N. Y. State Museum.

### Lasioptera palustris n. sp.

**Male.** Length 1.75 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, the basal segments yellowish, 20 segments; face fuscous yellowish with a rather conspicuous patch of silvery white scales, eyes narrowly margined posteriorly with silvery white. Mesonotum dark reddish brown, variably margined laterally and anteriorly with silvery white, the submedian lines thickly clothed with golden yellow scales, posterior median area reddish brown. Scutellum pale reddish brown with a few yellowish setae apically, postscutellum pale orange. Abdomen dark brown, the basal segments silvery white, the second to fourth segments rather broadly, and the fifth and sixth segments narrowly margined with silvery white, the latter obsolete laterally, the eighth segment pale orange; genitalia fuscous yellowish, venter dark brown with a broad median, silvery white stripe. Halteres pale salmon. Legs mostly brown, the extremities of femora and tibiae variably annulate with light yellowish, the tarsi dark brown.

**Female.** Length 2 mm. Antennae with 25 segments. Color characters about as in the opposite sex.

Bred May 24, 1907 from a very irregular, fusiform or subglobular stem gall occurring upon an unknown plant in marshy places at West Nyack, N. Y.

Type Cecid. a1443, N. Y. State Museum.

### Choristoneura erigerontis n. sp.

**Male.** Length 2.25 mm. Antennae very short, not extending to the base of the abdomen, sparsely haired, dark brown, yellowish basally, 14 segments; face with a conspicuous patch of silvery white scales. Mesonotum dark brown, the submedian lines sparsely clothed with yellowish setae. Scutellum dark reddish brown, postscutellum dark brown. Abdomen dark brown with rather large, submedian lunate spots on the posterior margin of each segment, incisures pale salmon, genitalia fuscous; venter suffused with silvery white scales. Halteres pale salmon. Legs mostly a variable dark brown, the basal two thirds of femora yellowish, tibiae and the first and last tarsal segments banded basally, and the others narrowly annulate basally and apically with silvery white, the annulations broader on the posterior legs.

**Female.** Length 2.5 mm. Antennae with 16 segments. Colorational characters about as in the opposite sex.

Bred May 29, 1907 from fusiform stem galls on horseweed, E r i g e r o n  c a n a d e n s e , taken at Albany, N. Y.

Type Cecid. a1427a, N. Y. State Museum.

### Choristoneura modesta n. sp.

**Female.** Length 2 mm. Antennae hardly extending to the base of the abdomen, sparsely haired, brown, lighter apically, 18 segments; face sparsely clothed with light scales. Mesonotum black, sparsely margined laterally and anteriorly by pale setae, a few light ones before the wings and on the pleurae. Scutellum a little lighter than the mesonotum. Abdomen black, the segments margined posteriorly with a very narrow line of light scales, interrupted mesially and with a few scattered light scales laterally. Halteres whitish basally, translucent apically, fuscous subapically. Legs black above, lighter beneath.

**Male.** Length 2.25 mm. Antennae with 14 segments. Color characters nearly as in the opposite sex.

Bred May 20, 1907 presumably from small, oval swellings appearing much like arrested buds, on the stems of horseweed, E r i g e r o n  c a n a d e n s e , taken at Albany, N. Y.

Type Cecid. a1427, N. Y. State Museum.

### *Cecidomyia ramuli* n. sp.

**Female.** Length 2.5 mm. Antennae extending to the fifth abdominal segment, sparsely haired, pale yellowish, 14 segments; face light fuscous yellowish, eyes rather large, black. Mesonotum yellowish brown, the submedian lines lighter, rather thickly clothed with long hairs, the posterior median area light reddish yellow. Scutellum light reddish with a few apical setae, postscutellum reddish brown. Abdomen deep reddish orange, the segments sparsely clothed posteriorly with fine hairs. Halteres yellowish transparent basally and apically, light fuscous subapically. Coxae and base of femora yellowish transparent, the remainder of femora, tibiae and tarsi a uniform dark brown, the second and third tarsal segments on the posterior legs fuscous yellowish.

Bred May 25, 1907 from a small, monothalamous, almost imperceptible enlargement on the smaller twigs of *Cornus paniculata*, taken at Albany, N. Y.

Type Cecid. a1384, N. Y. State Museum.

### *Choristoneura solani* n. sp.

**Female.** Length 1.5 mm. Antennae extending to the base of the abdomen, sparsely haired, dark brown, 23 segments, the black eyes sparsely margined posteriorly with silvery white. Mesonotum dark reddish brown, broadly and irregularly margined laterally and anteriorly with yellowish white, the submedian lines rather thickly clothed with short, yellowish setae. Scutellum reddish yellow with a few small setae apically, postscutellum reddish brown. Abdomen dark brown, the first abdominal segment thickly clothed with yellowish white scales, the second to fifth segments narrowly margined posteriorly with silvery white, the latter rather broadly interrupted along the median lines; ovipositor pale yellowish, venter rather thickly suffused with silvery white scales. Halteres pale yellowish transparent. Coxae and base of femora mostly pale yellowish, the other parts of the legs a variable dark brown, the tarsi lighter.

Bred April 16, 1896 from stem gall on *Solanum carolinense* taken at Ivy City, D. C.

Type Cecid. 903, N. Y. State Museum, No. 6822 U. S. Bureau Entomology.

**Asphondylia diervillae** n. sp.

**Female.** Length 3.5 mm. Antennae extending to the fourth abdominal segment, sparsely haired, grayish brown, 14 segments; face fuscous, eyes large, black, margined posteriorly with long, fuscous setae. Mesonotum dull slate color, irregularly margined laterally with long, grayish setae, the submedian lines thickly clothed with similar setae. Scutellum slaty gray with long setae apically, postscutellum fuscous yellowish. Abdomen a nearly uniform dark brown, the segments sparsely margined posteriorly with long, gray setae, pleurae and abdomen rather thickly clothed with yellowish white setae. Halteres yellowish basally, fuscous apically, coxae a dull gray, the base of femora dull yellowish, the other portions of the legs dark brown, the tarsi darker, almost black.

Bred May 23, 1907 from a green bud gall on bush-honeysuckle taken at Albany, N. Y.

Type Cecid. a1469, N. Y. State Museum.

EXPLANATION OF PLATES

**Plate I**

Thysania zenobia Cramer, natural size

Plate 1

Thysania zenobia Cramer

Plate 2

Work of the sugar maple borer. Photograph of a sugar maple tree which was half girdled by the sugar maple borer (Plagionotus speciosus Say) in September 1889. Photographed November 1906

Plate 2

Le Roy, N. Y. Nov. 1906

Work of sugar maple borer

Plate 3

Apple twig from Annandale, N. Y., showing 10 year old oviposition scars of the 17 year cicada (*Tibicen septendecim* Linn.). The injury was inflicted in 1896; photographed September 1906

Plate 3

Photo July 1906

Work of periodical cicada

# INDEX

The superior figures tell the exact place on the page in ninths; e. g. $129^3$ means page 129, beginning in the third ninth of the page, i. e. about one third of the way down.

Appendix 4

# Botany 10

*Museum bulletin* 116

10 Report of the State Botanist 1906

*Published monthly by the*

**New York State Education Department**

BULLETIN 404 JULY 1907

# New York State Museum

JOHN M. CLARKE, Director

CHARLES H. PECK, State Botanist

**Bulletin 116**

BOTANY 10

## REPORT OF THE STATE BOTANIST 1906

*New York State Education Department*
*Science Division, January 18, 1907*

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

SIR: I communicate herewith, for publication as a bulletin of the State Museum, the annual report of the State Botanist for the fiscal year ending September 30, 1906.

Very respectfully

JOHN M. CLARKE
*Director*

*State of New York*

**Education Department**

COMMISSIONER'S ROOM

*Approved for publication this 18th day of January 1907*

A. S. Draper

*Commissioner of Education*

New York State Education Department

# New York State Museum

JOHN M. CLARKE, Director
CHARLES H. PECK, State Botanist

Bulletin 116

BOTANY 10

## REPORT OF THE STATE BOTANIST 1906

*Dr John M. Clarke, Director of Science Division:*

I have the honor of submitting to you the following report of work done in the botanical department of the State Museum during the year 1906.

Specimens of plants for the State herbarium have been collected in the counties of Albany, Columbia, Dutchess, Essex, Fulton, Greene, Hamilton, Herkimer, Madison, Oneida, Putnam, Rensselaer, Saratoga, Steuben, Suffolk and Warren.

Specimens of New York species have been received from contributors and correspondents, that were collected in the counties of Albany, Allegany, Chautauqua, Columbia, Essex, Fulton, Herkimer, Dutchess, Madison, Monroe, Oneida, Onondaga, Orange, Orleans, Rensselaer, Richmond, Saratoga, Steuben, Suffolk, Tompkins, Warren and Washington.

The number of species of which specimens have been added to the State herbarium is 156. Of these, 60 are species new to the herbarium, 96 are not new. Of the former number, 20 are considered new or undescribed species and descriptions of these will be found in another part of this report. A list of the names of added species is given under the title " Species added to the herbarium."

The number of those who have contributed specimens is 61. This includes many who have sent extralimital specimens or specimens simply for identification, but if the specimens were in good condition when received and were suitable or desirable for the herbarium they have been preserved and credited to the sender as a contribution. A list of the names of the contributors and their respective contributions will be found under the title " Contributors and their contributions."

The number of species found or of which specimens have been

contributed that are deemed new to our New York flora is 67. A record of these with their localities and descriptions of new species is given under the title "Species not before reported."

Descriptions of five new but extralimital species and one new variety have been added to this chapter.

A record of new stations of rare plants, of new varieties and forms of well known species, remarks concerning distinguishing characters of closely related species or observations of unusual features in some species are given under the title "Remarks and observations." The number of New York species noticed in this chapter is 27.

The study of our fleshy fungi and the collection of specimens of them for the herbarium have been continued, though much of the season has been singularly unfavorable to their production. Rain and showers were frequent in the early part of summer but the prevailing low temperature was detrimental to the growth of these plants. As the weather became warmer the rains ceased and excessive dryness prevented their growth. September is usually one of the best months of the year for mushroom growths, but this season it was one of the poorest. Late fall rains, however, brought out a delayed crop which was available at a much later date than usual and helped to make good the deficiency of the earlier part of the season. The number of species of fungi added to the herbarium is 39 of which 17 are new species.

The trial of the edible qualities of our wild mushrooms has resulted in adding 11 species to our list of those deemed edible, and makes the whole number of New York species of this class 183. Of the 11 added species 9 have been illustrated by colored figures of natural size. Figures of the 2 remaining species, Russula earlei Pk. and Boletus rugosiceps Pk. have been published in preceding reports. Descriptions of the 11 species tested and approved this year will be found under the title "Edible fungi."

The study of our Crataegus flora has been continued with much interest. Specimens have been collected in the northern, eastern, central and southwestern parts of the State. The number of species added to the State flora is 8, of which two are new species. This addition makes the number of New York species now known 97. Many specimens of this genus still remain undetermined. The destructive influence of late frosts was clearly seen in the failure of many thorn bushes which bore a full crop of flowers to

develop any fruit. The essential floral organs were frozen and consequently the fruit failed to develop. In such cases the stamens and pistils are sometimes frozen before the buds open. When the flowers appear they look fresh and fair at a distance but on close inspection the stamens and pistils are seen to be dead and blackened. If the freeze is very severe after the buds are much swollen no species escapes. If less severe, only the flowers of the most tender species or those which are in the most susceptible condition are killed. During the past season many species of the Tomentosae group failed to develop fruit though at flowering time they were full of blossoms. Species in the same locality whose time of flowering is earlier may escape injury.

The comparatively large genera Hygrophorus and Russula present some peculiar difficulties. The subgenera are not sharply differentiated and in some cases American species appear to combine characters of two subgenera or do not in all respects agree with the characters ascribed to any of the subgenera. Nevertheless a revision of the New York species of these genera has been attempted and the Friesian arrangement of the subgenera and species followed as far as possible. Descriptions have been rewritten and in some cases made more full and satisfactory.

The plan of identifying specimens of plants for correspondents and others who send or bring them to the office for that purpose has been followed. This not only results in the dissemination of useful botanical knowledge, but also in sometimes acquiring interesting and valuable specimens for the herbarium that otherwise might fail to reach it. The number of those for whom determinations of specimens have been made is 82. The number of determinations is 435.

Botanical specimens representing 20 species of trees have been collected but not included in the foregoing enumeration. They are intended to replace the lost or damaged specimens of the swinging frames, which loss occurred while these were absent at the St Louis and Portland expositions.

An additional table case of specimens of parasitic fungi has been prepared and placed in the botanical exhibition room. It contains specimens of 24 species some of which are injurious to cultivated plants, some to wild plants.

The case containing the specimens of the Japanese edible mushroom Shiitake, Pleurotus bretschneideri Kalchb., on the branches where they grew, has been repaired and placed on ex-

hibition. It is surmounted by a bell jar filled with the dried mushrooms in the condition in which they are offered for sale in the markets of China and Japan.

Mr S. H. Burnham, the Assistant Botanist, has been chiefly occupied with office work. He has incorporated the collections of 1905 in their proper places, has disinfected and labeled the specimens, attended to the correspondence of the office in my absence, identifying specimens sent for determination and giving information sought concerning them. He has prepared a card catalogue with descriptive references of the new species of fungi described by the State Botanist.

Respectfully submitted

Charles H. Peck

*State Botanist*

*Office of the State Botanist*

*Albany, December 26, 1906*

# SPECIES ADDED TO THE HERBARIUM

## *New to the herbarium*

Allionia hirsuta *Pursh*
Amanitopsis pulverulenta *Pk.*
Ascochyta pisi *Lib.*
Aster arcifolius *Bu.*
A. elaeagnus *Bu.*
A. fragrans *Bu.*
A. multiformis *Bu.*
A. violaris *Bu.*
Boletus subpunctipes *Pk.*
Caryospora cariosa *Fairm.*
Collybia campanella *Pk.*
C. lacerata *Lasch.*
Cortinarius intrusus *Pk.*
C. validipes *Pk.*
Crataegus arcana *Beadle*
C. bissellii *Sarg.*
C. cognata *Sarg.*
C. deltoides *Ashe*
C. habereri *Sarg.*
C. noveboracensis *Sarg.*
C. scabrida *Sarg.*
C. tenella *Ashe*
Cynoglossum boreale *Fern.*
Didymium clavus (*A. & S.*) *Rabenh.*
Dryopteris pittsfordensis *Slo.*
Entoloma minus *Pk.*
Flammula expansa *Pk.*
Gaura coccinea *Pursh*
Hydnum luteopallidum *Schw.*
Hygrophorus burnhami *Pk.*
Hygrophorus luridus *B. & C.*
Hypocrea pallida *E. & E.*
Inocybe pallidipes *E. & E.*
Lepiota asperula *Atk.*
L. eriophora *Pk.*
Leptoglossum fumosum *Pk.*
Linum medium (*Planch.*) *Britton*
Marasmius phyllophilus *Pk.*
Mycena albogrisea *Pk.*
Nicandra physaloides *Gaertn.*
Ohleria modesta *Fckl.*
Omphalia pusillissima *Pk.*
Panicum deminutivum *Pk.*
Peckiella hymenii *Pk.*
Phyllosticta ampelopsidis *E. & M.*
P. smilacis *E. & E.*
P. sphaeropsidea *E. & E.*
Pleurotus terrestris *Pk.*
Polyporus galactinus *Berk.*
Puccinia peckii (*DeT.*) *Kell.*
Russula foetentula *Pk.*
R. modesta *Pk.*
R. pectinatoides *Pk.*
R. vesca *Fr.*
Scleroderma tenerum *B. & C.*
Septoria lycopersici *Speg.*
Steccherinum adustulum *Banker*
Stemonitis smithii *Macb.*
Tricholoma hirtellum *Pk.*
Viola incognita *Brainerd*

## *Not new to the herbarium*

Agastache scrophulariaefolia (*Willd.*)
Amanitopsis volvata (*Pk.*) *Sacc.*
Aquilegia canadensis *L.*
Arctium lappa *L.*
Asarum canadense *L.*
Aster camptilis *Bu.*
A. claytoni *Bu.*
A. concolor *L.*
Boletus auriporus *Pk.*
B. frostii *Russ.*
B. nigrellus *Pk.*
B. peckii *Frost*
Boletus rugosiceps *Pk.*
Bromus tectorum *L.*
Castanea dentata (*Marsh.*) *Borkh.*
Catastoma circumscissum (*B. & C.*)
Chrysomyxa pyrolae (*DC.*) *Rostr.*
Chrysopsis mariana *Nutt.*
Clavaria botrytoides *Pk.*
C. cristata *Pers.*
Clitocybe amethystina (*Bolt.*)
C. monadelpha *Morg.*
C. ochropurpurea *Berk.*
Clitopilus prunulus (*Scop.*) *Fr.*

Coreopsis rosea *Nutt.*
Cornus alternifolia *L. f.*
C. candidissima *Marsh.*
Crataegus caesariata *Sarg.*
C. coccinea *L.*
C. ferentaria *Sarg.*
C. illuminata *Sarg.*
C. intricata *Lange*
C. laneyi *Sarg.*
C. pedicellata *Sarg.*
C. pringlei *Sarg.*
C. punctata *Jacq.*
C. spissiflora *Sarg.*
C. tenuiloba *Sarg.*
Craterellus cantharellus (*Schw.*)
Cypripedium acaule *Ait.*
Daedalea quercina (*L.*) *Pers.*
Dasystoma virginica (*L.*) *Britt.*
Dryopteris boottii (*Tuck.*) *Under.*
D. cristata (*L.*) *Gray*
D. cris. clintoniana (*Eat.*)
D. simulata *Dav.*
Eleocharis inter. habereri *Fern.*
E. melanocarpa *Torr.*
Gentiana crinita *Froel.*
Hydnum aurantiacum *A. & S.*
H. fennicum (*Karst.*) *Sacc.*
H. imbricatum *L.*
H. repandum *L.*
H. vellereum *Pk.*
H. zonatum *Batsch*
Hypopitys lanuginosa (*Mx.*) *Nutt.*
Ilex vert. cyclophylla *Robins.*
Inocybe calamistrata *Fr.*
Irpex canescens *Fr.*
Lactarius ful. fumosus *Pk.*
L. pergamenus *Fr.*
Lactarius piperatus *Fr.*
L. vellereus *Fr.*
L. volemus *Fr.*
Lespedeza angustifolia *Pursh*
L. hirta (*L.*) *Ell.*
L. virginica (*L.*) *Britt.*
Lobelia dortmanna *L.*
Lycopus sessilifolius *Gray*
Meibomia marilandica (*L.*) *Kuntze*
M. rigida (*Ell.*) *Kuntze*
Monarda punctata *L.*
Mycena galericulata (*Scop.*)
Physarum lateritium (*B. & R.* )
Polyporus schweinitzii *Fr.*
P. sulphureus (*Bull.*)
Polystichum acrostichoides (*Mx.*)
Polystictus simillimus *Pk.*
P. subsericeus *Pk.*
Populus balsamifera *L.*
Russula earlei *Pk.*
Sagina procumbens *L.*
Scirpus atro. pycnocephalus *Fern.*
S. cyp. pelius *Fern.*
Senecio obovatus *Muhl.*
Solidago tenuifolia *Pursh*
Sporobolus serotinus (*Torr.*) *Gray*
Stereum versicolor *Fr.*
Strobilomyces strobilaceus (*Scop.*)
Trillium erect. album *Pursh*
Tricholoma alboflavidum *Pk.*
T. nudum (*Bull.*) *Fr.*
Viburnum lentago *L.*
Viola blanda *Willd.*
V. cucullata *Ait.*
V. fimbriatula *Sm.*
Woodwardia areolata (*L.*) *Moore*

## CONTRIBUTORS AND THEIR CONTRIBUTIONS

**Mrs E. B. Blackford,** Boston Mass.

Lactarius varius *Pk.*
Omphalia epichysium *Pers.*
Hygrophorus serotinus *Pk.*

**Miss M. B. Church,** Albany

Pleurotus porrigens (*Pers.*) *Fr.*

**Mrs M. S. DeCoster,** Little Falls

Viola incognita *Brainerd*
Viola selkirkii *Pursh*

**Mrs G. M. Dallas,** Philadelphia Pa.
Opuntia humifusa *Raf.*

**Miss Alice Eastwood,** San Francisco Cal.
Lentinus magnus *Pk.*

**Mrs L. L. Goodrich,** Syracuse
Trillium erectum album *Pursh*

**Mrs M. A. Knickerbocker,** San Francisco Cal.
Scoliopus bigelovii *Torr.*

**Miss E. A. Lehman,** Winston-Salem N. C.
Monotropsis lehmanae *Burnh.*

**Mrs J. Rogers,** Ausable Forks
Lepiota naucinoides *Pk.*

**Miss A. M. Ryan,** New London Ct.
Marsonia violae (*Pass.*) *Sacc.*

**Miss T. L. Smith,** Worcester Mass.
Russula modesta *Pk.*

**Mrs F. C. Sherman,** Syracuse
Pleurotus ulmarius *Fr.*

**Mrs C. E. Taft,** New York city
Collybia velutipes (*Curt.*) *Fr.*

**Mrs E. S. Tomlinson,** New York city
Polystichum acrostichoides incisum (*Gr.*) *Under.*

**F. H. Ames,** Brooklyn
Ammodenia peploides (*L.*) *Bupr.* | Hudsonia tomentosa *Nutt.*
Woodwardia areolata (*L.*) *Moore*

**J. C. Arthur,** Lafayette Ind.
Aecidium coloradense *Diet.* | Peridermium boreale *Arth.*
Peridermium carneum (*Bosc*) *S. & E.*

**G. F. Atkinson,** Ithaca
Cortinarius intrusus *Pk.* | Lepiota asperula *Atk.*
Russula constans *Karst.*

**H. J. Banker**, Greencastle Ind.

Onygena equina *Pers.*
Steccherinum adustulum *Banker*

**Elam Bartholomew**, Stockton Kan.

Aecidium abundans *Pk.*
Ae. allenii *Clint.*
Ae. diodiae *Burr.*
Ae. grindeliae *Griff.*
Ae. grossulariae *(Pers.) Schm.*
Ae. pammelii *Trel.*
Ae. punctatum *Pers.*
Ae. solidaginis *Schw.*
Albugo amaranthi *(Schw.) Kze.*
A. candidus *(Pers.) Kze.*
Arthosporium compositum *Ell.*
Cercospora pachypus *E. & K.*
C. vignae *E. & E.*
Coleosporium solidaginis *(Schw.)*
Coniosporium arundinis *(Cd.) Sacc.*
Cronartium asclepiadeum *Berk.*
Cucurbitaria salicina *Fckl.*
Cudonia circinans *(Pers.) Fr.*
Diplodia liriodendri *Pk.*
Dothidea linderae *Ger.*
Exobasidium vaccinii *(Fckl.) Wor.*
Geaster pectinatus *Pers.*
Geoglossum hirsutum *Pers.*
G. peckianum *Cke.*
Gymnosporangium clavipes *C. & P.*
Humaria cestrica *E. & E.*
Hypomyces lactifluorum *(Schw.) Tul.*
Leotia lubrica *(Scop.) Pers.*
Macrosporium ornatissimum *E. & B.*
Marsonia castagnei *(D. & M.) Sacc.*
Massariella bufonia *(B. & Br.) Tul.*
Meliola nidulans *(Schw.) Cke.*
Mitrula olivacea *(Pers.) Sacc.*
M. serpentina *(Muell.) Mass.*
Oidium monilioides *Lk.*
Peronospora calotheca *DeBy.*
P. euphorbiae *Fckl.*
Phyllachora graminis panici *(Schw.)*
Plasmopara geranii *(Pk.) B. & DeT.*
Psilocybe sabulosa *Pk.*
Puccinia absinthi *DC.*
P. agropyri *E. & E.*
P. asparagi *DC.*
P. asteris *Duby*
P. caricis *(Schum.) Reb.*
P. cyperi *Arth.*
Puccinia fraxinate *(Lk.) Arth.*
P. helianthi *Schw.*
P. heucherae *(Schw.) Diet.*
P. lycii *Kalchb.*
P. menthae *Pers.*
P. muhlenbergiae *A. & H.*
P. physalidis *Pk.*
P. pimpinellae *(Strauss.) Lk*
P. prenanthis *(Pers.) Fckl.*
P. proserpinacae *Farl.*
P. purpurea *Cke.*
P. rubinella *(Pers.) Arth.*
P. silphii *Schw.*
P. stipae *Arth.*
P. tecta *E. & B.*
P. tosta *Arth.*
P. verbesinae *Schw.*
P. veroniae *Schw.*
Rhizographus fusariisporus *E. & E.*
Rhizopus nigricans *Ehrenb.*
Schizothyrella fraxini *E. & E.*
Sclerospora graminicola *(Sacc.)*
Scolecotrichum asclepiadis *E. & E.*
Septoria aurea destruens *E. & E.*
S. munroae *E. & B.*
Sorosporium syntherismae *(Pk.) Farl.*
Sphaeropsis cydoniae *C. & E.*
Stichopsora solidaginis *(Schw.) Diet.*
Teichospora populina *E. & E.*
Tricholoma portentosum *Fr.*
Tubercinia clintoniae *Kom.*
Tuberculina persicina *(Ditm.) Sacc.*
Typhula muscicola *(Pers.) Fr.*
Uromyces caladii *(Schw.) Farl.*
U. euphorbiae *C. & P.*
U. gentianae *Arth.*
U. glycyrrhizae *(Reb.) Magn.*
U. gnaphalii *E. & E.*
U. hordei *Tracy*
U. howei *Pk.*
U. junci *(Desm.) Tul.*
U. lespedezae *(Schw.) Pk.*
U. trifolii *(Hedw.) Lev.*
Ustilago utriculosa *(Nees) Tul.*
Xylaria digitata *(L.) Grev.*

**M. S. Baxter,** Rochester

Crataegus laneyi *Sarg.*
C. pedicellata *Sarg.*
Crataegus tenuiloba *Sarg.*
Pentstemon laevigatus *Soland.*

**M. S. Baxter and V. Dewing,** Rochester

Allionia hirsuta *Pursh*
Gaura coccinea *Pursh*
Conringia orientalis *(L.) Dum.*

**R. C. Benedict,** New York city

Dryopteris pittsfordensis *Slosson*

**A. F. Blakeslee,** Cambridge Mass.

Phycomyces nitens *(Ag.) Kunze*

**F. S. Boughton,** Pittsford

Clitocybe dealbata *Sow.*
Pleurotus subareolatus *Pk.*
Tricholoma columbetta *Fr.*

**F. J. Braendle,** Washington D. C.

Clavaria cinerea *Bull.*
Collybia zonata *Pk.*
Geaster saccatus *Fr.*
Isaria truncata *Pers.*
Mycenastrum spinulosum *Pk.*
Viola villosa *Walt.*

**S. H. Burnham,** Sandy Hill

Cordyceps capitata *(Holmsk.) Lk.*
Cynoglossum boreale *Fern.*
Erysiphe polygoni *DC.*
Flammula expansa *Pk.*
Hygrophorus burnhami *Pk.*
Lentinus spretus *Pk.*
Pleurotus terrestris *Pk.*
Polyporus borealis *Wahl.*
Polystichum acrostichoides *(Mx.)*
Russula cyanoxantha *(Schaeff.) Fr.*
Scapania irrigua *(Nees) Dum.*
Timmia megapolitana *Hedw.*
Lepiota asperula *Atk.*

**G. H. Chadwick,** Albany

Thelephora schweinitzii *Pk.*

**G. D. Cornell,** Coopers Plains

Arabis glabra *(L.) Bernh.*
Hieracium praealtum *Vill.*
Hypericum ascyron *L.*
Lilium canadense *L.*
Liriodendron tulipifera *L.*
Magnolia acuminata *L.*
Solidago juncea *Ait.*
Sisyrinchium angustifolium *Mill.*

**W. C. Cottrell,** Gloversville

Nicandra physaloides *Gaertn.*

**Simon Davis,** Brookline Mass.

Agaricus camp. hortensis *Cke.*
Coprinus plicatilis *Fr.*
C. stenocoleus *Lindb.*
Eccilia unicolor *Pk.*
Entoloma sericellum *Fr.*
E. sericeum (*Bull.*) *Fr.*
Galera sphagnorum *Pers.*
Hygrophorus davisii *Pk.*
Hygrophorus luridus *B. & C.*
H. mephiticus *Pk.*
H. nitratus (*Pers.*) *Fr.*
H. prat. albus *Sacc.*
Inocybe infelix *Pk.*
Leptonia transformata *Pk.*
Marasmius scorodonius *Fr.*
Psathyrella angusticeps *Pk.*
Russula compacta *Frost*

**W. T. Davis,** New Brighton

Aronia arbutifolia (*L.*) *Medic.*
Aronia atropurpurea *Britton*

**Frank Dobbin,** Shushan

Arthonia quintaria *Nyl.*
Arthonia radiata (*Pers.*) *Th. Fr.*
Discina orbicularis *Pk.*

**Philip Dowell,** Port Richmond

Dryopteris boottii (*Tuck.*) *Under.*
D. cristata (*L.*) *Gray*
D. crist. clintoniana (*Eat.*)
D. crist. marginalis *Dav.*
Dryopteris goldieana (*Hook.*) *Gray*
D. pittsfordensis *Slos.*
D. simulata *Dav.*
Woodwardia areolata (*L.*) *Moore*

**C. E. Fairman,** Lyndonville

Brachysporium obovatum (*Berk.*) *Sacc.*
Caryospora cariosa *Fairm.*
Didymium clavus (*A. & S.*) *Rabh.*
Nemosphaeria fairmani *Sacc.*
Ohleria modesta *Fckl.*
Physarum lateritium (*B. & R.*) *Rost.*

**O. E. Fischer,** Detroit Mich.

Agaricus camp. hortensis *Cke.*
Lepiota eriophora *Pk.*
Hydnum adustum *Schw.*

**N. M. Glatfelter,** St Louis Mo.

Guepinia palmiceps *Berk.*
Lepiota cep. lutea *With.*
Merulius rubellus *Pk.*
Pterula densissima *B. & C.*
Thelephora caespitulans *Schw.*

**P. W. Graff,** Storrs Ct.

Poronia macrospora *Pk.*
Xylaria polymorpha combinans *Pk.*

**Cephas Guillet,** Toronto Ont.

Hygrophorus miniatus *Fr.*
Lactarius paludinellus *Pk.*

**C. C. Hanmer,** East Hartford Ct.

Collybia lacerata *Lasch.*
Entoloma cuspidatum *Pk.*
Hygrophorus chlorophanus *Fr.*
Panus levis *B. & C.*

**M. E. Hard,** Chillicothe O.

Hydnum ochraceum *Pers.*
Tricholoma fumescens *Pk.*

**J. J. Hare,** Whitby Ont.

Hypholoma sublateritium squamosum *Cke.*

**J. E. S. Heath,** South Pasadena Cal.

Daldinia vernicosa (*Schw.*) *C. & D.*

**A. P. Hitchcock,** New Lebanon

Lycoperdon giganteum *Batsch*

**G. S. Howell,** Rockville Ind.

Tricholoma album *Schaeff.*

**C. H. Kauffman,** Ann Arbor Mich.

Crepidotus ralfsii *B. & Br.*
Cortinarius multiformis *Fr.*
Hypholoma vinosum *Kauff.*
Lepiota gracilis *Pk.*
Mycena glutinipes *Kauff.*
Pleurotus petaloides (*Bull.*) *Fr.*

**W. A. Kellerman,** Columbus O.

Galera kellermani *Pk.*
Psathyrella hirta *Pk.*

**F. D. Kern,** Lafayette Ind.

Puccinia graminis *Pers.*

**R. B. Mackintosh,** Peabody Mass.

Agaricus campester *L.*
Agaricus rodmani *Pk.*

**Charles McIlvaine,** Cambridge Md.

Lepiota morgani *Pk.*

**George E. Morris,** Waltham Mass.

Hygrophorus pallidus *Pk.*
H. ruber *Pk.*
Lepiota eriophora *Pk.*
Steccherinum adustulum *Banker*

**L. J. Muchmore,** Batavia

Hydnum luteopallidum *Schw.*
Oligonema nitens (*Lib.*) *Rost.*
Stemonitis smithii *Macb.*

**F. M. Rolfs,** Mountain Grove Mo.

Phyllosticta rubra *Pk.*

**W. H. Ropes,** Salem Mass.

Agaricus micromegethus *Pk.*

**I. M. Shepherd,** Trenton, N. J.

Morchella esculenta (*L.*) *Pers.*

**F. S. Smith,** Angelica

Bacillus amylivorus *Burr.*
Fusicladium pirinum (*Lib.*) *Fckl.*

**Perley Spaulding,** St Louis Mo.

Fomes annosus *Fr.*
Hydnum artocreas *Berk.*
Merulius lac. verrucifer *Quel.*
M. rubellus *Pk.*

**E. B. Sterling,** Trenton N. J.

Arachnion album *Schw.*
Calostoma cinnabarinum *Desv.*
Inocybe sterlingii *Pk.*
Lycoperdon excoriatum *Lloyd*
L. pusillum *Batsch*
L. serotinum *Bon.*
L. stellare (*Pk.*) *Lloyd*
Lycoperdon tessellatum *Lloyd*
Pholiota discolor *Pk.*
Pluteus petasites *Fr.*
Sarcoscypha dawsonensis *Pk.*
Scleroderma aurantiaca *Pers.*
S. cepa *Pers.*
S. verrucosum (*Bull.*)

**D. R. Sumstine,** Wilkinsburg Pa.

Pyronema leucobasis (*Pk.*) *Sacc.*

**Hermann von Schrenk,** St Louis Mo.

Paxillus panuoides *Fr.*
Trametes serialis *Fr.*

**K. F. Symonds,** Utica

Clitocybe ochropurpurea *Berk.*

**E. A. White,** Storrs Ct.

Phallogaster whitei *Pk.*

**T. E. Wilcox,** Washington D. C.

Boletus retipes *B. & C.*
B. rimosellus *Pk.*
B. subtomentosus *L.*
Clavaria pistillaris *L.*
Collybia strictipes *Pk.*
Hymenogaster anomalus *Pk.*
Tricholoma columbetta *Fr.*

**W. W. Eggleston,** New York city

By exchange

Crataegus arcana *Ashe*
C. coccinea *L.*
C. cognata *Sarg.*
Crataegus deltoides *Ashe*
C. dissona *Sarg.*
C. dodgei *Ashe*

Crataegus glaucophylla *Sarg.*
C. intricata *Lange*
C. matura *Sarg.*
Crataegus modesta *Sarg.*
C. pentandra *Sarg.*
C. pruinosa *Wendl.*
Crataegus tenella *Ashe*

## SPECIES NOT BEFORE REPORTED

### **Allionia hirsuta** Pursh

Near Rochester. August. M. S. Baxter and V. Dewing. Introduced from the western states. It is Oxybaphus hirsutus Sweet.

### **Amanitopsis pulverulenta** n. sp.

Pileus thin, convex becoming nearly plane, pulverulent, squamose in the center, even on the margin, white or creamy white, odor feeble or none; lamellae thin, unequal, narrowed behind, free or nearly so, moderately close, subventricose, whitish; stem equal or slightly tapering upward, bulbous, solid, pulverulent or furfuraceous, white; spores subelliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 2–3 lines thick.

Shaded banks by roadsides. Port Jefferson, Suffolk co. August.

This species is well marked by its white color and the copious mealiness of the pileus and stem. It is apparently closely related to Amanitopsis pubescens (Schw.) but it differs from the description of that species in having the pileus and stem pulverulent instead of pubescent and in the former being squamose in the center. There is no annulus and the slight remains of a membranous volva are seen in very young specimens only. In the dried specimens the lamellae have assumed a pale yellowish cinnamon hue.

### **Ascochyta pisi** Lib.

Living pods of peas and beans. Menands, Albany co. July. This parasitic fungus produces discolored spots on the pods similar to the anthracnose spots of bean pods, but the spores of this fungus are uniseptate, those of the anthracnose, simple.

### **Aster arcifolius** Bu.

Lake Minnewaska, Ulster co. September. Prof. E. Burgess has made a special study of the asters of our country and his revision and elucidation of the Biotian division of the genus enables

me to add to our New York flora several species which were formerly supposed to be varieties of Aster divaricatus, A. macrophyllus and other closely related species.

### Aster biformis Bu.

Rathboneville, Steuben co. and Voorheesville, Albany co. August and September. In this species the lower stem leaves are petiolate and cordate with a deep narrow sinus, the upper leaves are abruptly reduced to a smaller size and are nearly or quite sessile. This difference between the upper and lower leaves is suggestive of the specific name.

### Aster camptilis Bu.

Low rocky ground. Lake Minnewaska. September. A slender aster with a weak stem which is often reclined or bent as if too feeble to support its own branches or hold itself erect. This character is suggestive of the name bent stemmed aster.

### Aster claytoni Bu.

Open places. Menands, Albany co. September. A large and variable species belonging to the group Divaricati. Specimens are sometimes 3 feet tall.

### Aster elaeagnus Bu.

North Elba, Essex co. August. A northern species having orbicular or ovate radical leaves and variable stem leaves which are pale and hairy on the under side. This gives a scurfy appearance suggestive of the scurfy character of Elaeagnus leaves. The species belongs to the group Macrophylli.

### Aster fragrans Bu.

Round Lake, Saratoga co. September. This species differs from A. divaricatus, to which it was formerly referred, in its more persistent fragrance, more compact panicle of flowers and more truncate base of its leaves.

### Aster multiformis Bu.

Lake Minnewaska, Ulster co. September. A species remarkable for its long slender rootstocks and the many forms shown by the leaves of the same plant.

**Aster violaris** Bu.

Rathboneville, Steuben co. August. This species is distinguished by its suborbicular and reniform apiculate radical and lower stem leaves. It belongs to the group Macrophylli.

**Boletus subpunctipes** n. sp.

Pileus fleshy, broadly convex, often uneven on the surface, becoming soft with age, brown, reddish brown when dry, flesh white, slowly becoming dingy where cut or broken, taste mild; tubes nearly plane in the mass, adnate or but slightly depressed around the stem, the mouths small, round, whitish or grayish white, changing to reddish brown where wounded; stem equal or nearly so, solid, slightly reticulate at the top, very minutely dotted, sometimes obscurely squamulose at the top, grayish or pallid; spores rusty brown or cinnamon brown, oblong or subfusiform, .0004–.0005 of an inch long, .0002–.00024 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 4–6 lines thick. Shaded sandy soil. Menands, Albany co. August.

The surface of the pileus is rendered uneven by coarse shallow depressions. The species belongs to the section Versipelles. The dots on the stem are nearly like those on the stem of Boletus chromapes Frost.

**Caryospora cariosa** Fairm.

In cavities of old beech wood. Lyndonville, Orleans co. C. E. Fairman.

**Collybia campanella** n. sp.

Pileus thin, conic or campanulate with a papilla at the apex, covered with coarse appressed or deflexed strigose hairs, dark tawny; lamellae ascending, moderately close, whitish; stem firm, equal, inserted, floccose hairy, colored like the pileus; spores not seen.

Pileus 3–4 lines broad; stem 9–12 lines long, .5 of a line thick. Dead and dry branches of arbor vitae, Thuja occidentalis. Horicon, Warren co. July.

This species is related to Collybia stipitaria from which it is readily distinguished by its persistently conic or campanulate pileus and its uniformly dark tawny color of both pileus and stem. The hairy tufts of the stem are pointed and project at right angles from the stem.

### **Collybia lacerata** Lasch.

Dry soil among grasses and bayberry bushes. Fishers island, Suffolk co. October. C. C. Hanmer. In these specimens the expanded pileus is umbonate and the umbo is darker colored than the rest. The specimens agree well with the figure of the species as given in Cooke's *Illustrations of British Fungi*. The spores in our specimens are broadly elliptic or subglobose and .00024–.0003 of an inch long.

### **Cortinarius intrusus** Pk.

Carnation beds in greenhouses. Highland Falls, Orange co. January. Ernest Palmer. Communicated by G. F. Atkinson. The species was described from specimens found growing in mushroom beds in conservatories in Massachusetts and New Jersey and communicated by R. Macadam and C. McIlvaine.

### **Cortinarius validipes** n. sp.

Pileus fleshy, thick, convex becoming nearly plane, dry, squamulose or floccose squamulose, ochraceous, flesh white tinged with yellow next the lamellae, taste mild; lamellae thin, narrow, close, adnate or decurrent with a tooth, yellowish white becoming cinnamon; stem stout, firm, solid, fibrous, striate at the top by the decurrent teeth of the lamellae, subannulate from the adherent remains of the webby veil, yellowish white, whitish within; spores subelliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 3–6 inches broad; stem 4–5 inches long, 1–2 inches thick. Coopers Plains, Steuben co. September.

A cluster of six plants was found growing in a small excavation near a farmhouse. The weather had been unusually warm and dry for several weeks, but a soaking rain two days before and a thunder shower one day later seem to have been favorable to the development of this large fine mushroom. It belongs to the section Dermocybe.

### **Crataegus arcana** Beadle

Moores Mills, Dutchess co. May and October. W. W. Eggleston.

### **Crataegus bissellii** Sarg.

Rocky pasture, near Staatsburg, Dutchess co. May and September. Our plants differ from the typical form of the species only in having stamens 5–8 and anthers pale pink soon fading to white.

**Crataegus cognata** Sarg.

Colemans Station, Dutchess co. and Dykemans, Putnam co. May and September. Mr Eggleston had previously found it in the latter locality.

**Crataegus deltoides** Ashe

Moores Mills. May and October. W. W. Eggleston. The broadly ovate or deltoid leaves constitute a prominent feature of this species and are suggestive of the specific name.

**Crataegus habereri** n. sp. Sarg.

Leaves broadly ovate, acute, rounded, subtruncate or abruptly cordate at the wide entire or glandular base, finely doubly serrate above, with straight glandular teeth, and divided usually only above the middle into four or five pairs of small acuminate spreading lobes, nearly half grown when the flowers open about the middle of May and then membranaceous, light yellow green and roughened above by short white hairs and pale and glabrous below, and at maturity thin, dark yellow green and scabrate on the upper surface, light yellow green on the lower surface, 4.5–6.5 cm long and nearly as wide; with slender midribs, and their primary veins extending obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, at first slightly villose, soon becoming glabrous, sparingly glandular while young, 2.5–3.5 cm in length; leaves on vigorous shoots truncate or rounded at the base, more coarsely serrate and more deeply lobed, often 7–8 cm long and 6–7 cm wide. Flowers 1.4–1.5 cm in diameter, on slender slightly hairy pedicels, in broad 5–8-flowered corymbs; calyx tube narrowly obconic, glabrous, or slightly hairy near the base, the lobes slender, acuminate, glandular serrate, glabrous on the outer, sparingly villose on the inner surface, reflexed after anthesis; stamens 10; anthers dark rose color; styles 3–5, surrounded at the base by a narrow ring of pale tomentum. Fruit ripening from the first to the middle of September, on glabrous reddish pedicels, in few-fruited drooping clusters, oval to obovate, crimson, lustrous, marked by large pale dots; calyx prominent, with a deep wide cavity, and incurved horizontal or recurved lobes dark red above toward the base and slightly hairy on the upper surface, their tips often deciduous from the ripe fruit; flesh thin, dark yellow, soft and succulent; nutlets 3–5, acute at the ends, slightly ridged and irregularly grooved on the back, 7–8 mm long and about 5 mm wide.

A shrub 3–5 m high, with small stems, wide spreading flexuous

branches, and slender slightly zigzag glabrous branchlets, light orange green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season, and dull reddish brown the following year, and armed with slender straight or slightly curved chestnut-brown spines 2.5–3 cm long.

Rocky pastures and margins of woods; New Hartford, Oneida co. J. V. Haberer (# 2410, type), May 20 and September 28, 1903; C. H. Peck, September 11, 1906.

This species, remarkable in its broad slightly lobed leaves and early ripening fruit, is named for its discoverer, Joseph Valentine Haberer M. D., an enthusiastic student of the flora of Herkimer, Oneida and Madison counties, the founder of the Asa Gray Botanical Club of Utica in 1886 and from that time to the present its president.

**Crataegus noveboracensis** n. sp. Sarg.

Leaves ovate, acuminate, abruptly concave cuneate at the entire base, finely doubly serrate above, with straight glandular teeth, and deeply divided into five or six pairs of narrow acuminate spreading lobes, more than half grown when the flowers open at the end of May and then thin, yellow green and covered above by short soft white hairs and paler and glabrous below, and at maturity thin but firm in texture, dark yellow green and lustrous on the upper surface and pale yellow green on the lower surface, 4.5–6.5 cm long and 4–5 cm wide, with slender yellow midribs, and thin primary veins arching obliquely to the points of the lobes; petioles slender, slightly wing-margined at the apex, villose on the upper side while young, becoming glabrous, sparingly glandular, 1–2 cm in length; leaves on vigorous shoots thicker, sometimes rounded or subtruncate at the broad base, more coarsely serrate and more deeply lobed, often 7–8 cm long and 6–7 cm wide, with stouter broadly winged petioles. Flowers 1.2–1.4 cm in diameter, on slender slightly villose pedicels, in usually 7–11-flowered lax corymbs; calyx tube narrowly obconic, coated especially near the base with long scattered white hairs, the lobes gradually narrowed, slender, acuminate, glandular serrate, glabrous on the outer, villose on the inner surface, reflexed after anthesis; stamens 15–20; anthers pale yellow; styles 4 or 5. Fruit ripening the middle of September, on slightly hairy reddish pedicels, in usually 5–7-fruited drooping clusters, subglobose to short oblong, full and rounded at the ends, crimson, lustrous, marked by large pale dots, about 1 cm in diameter; flesh thin, yellow, dry and mealy; nutlets 4 or 5, narrowed and rounded at the ends, slightly

ridged on the back, with a low slightly grooved ridge, 5.5–6 mm long and 4–5 mm wide.

A shrub 3–4 m high, with numerous small stems, ascending or suberect branches and slender nearly straight glabrous branchlets dark orange green when they first appear, becoming light chestnut-brown, lustrous and marked by pale lenticels in their first season and light gray brown the following year, and armed with numerous slender straight or slightly curved light chestnut-brown shining spines 4–5 cm long.

Sandy or rocky soil; Essex co. Common. North Elba, C. H. Peck (# 40, type), May 27, July 22 and September 14, 1903; C. H. Peck ( 40), Keene, May 31 and September 16, 1903.

### **Crataegus scabrida** Sarg.

Hilly and rocky pastures. West Albany, Albany co., C. H. Peck; New Hartford, Oneida co., J. V. Haberer. May and September. This is a large shrub or small tree which occurs in several places about Albany. It also occurs in Petersburg, Rensselaer co. Its fruit is edible.

### **Crataegus tenella** Ashe

Hilly and rocky pastures. Colemans Station and Moores Mills, Dutchess co.; Dykemans, Putnam co. May, September and October. W. W. Eggleston.

### **Cynoglossum boreale** Fern.

West Fort Ann, Washington co. June. S. H. Burnham.

### **Didymium clavus** (A. & S.) Rabenh.

Dead herbaceous stems. Grove Springs near Lake Keuka. July. C. E. Fairman. These specimens differ from typical forms in having a slightly smaller peridium.

### **Dryopteris pittsfordensis** Slosson

Springville, Richmond co. May. Philip Dowell. Solway, Onondaga co. R. C. Benedict.

### **Entoloma minus** n. sp.

Pileus thin, subconic or hemispheric, becoming broadly convex, glabrous, grayish brown, darker in the center; lamellae thin, close, ascending at first, sinuate behind, whitish becoming flesh color;

stem slender, hollow, white; spores subglobose, angular, .0003–.0004 of an inch in diameter.

Pileus 8–12 lines broad; stem 1–1.5 inches long, about 1 line thick. Ground in woods. East Schaghticoke, Rensselaer co. August.

**Flammula expansa** n. sp.

Pileus thin, broadly convex or nearly plane, glabrous or sometimes with appressed spotlike scales in the center, subochraceous, flesh white, taste mild; lamellae thin, narrow, close, yellow, changing to brown where wounded; stem short, equal, solid, brownish without, yellow within; spores broadly elliptic, .0003 of an inch long, .00024 broad.

Pileus 1–3 inches broad; stem about 1 inch long, 2–3 lines thick. Decaying wood of red maple, Acer rubrum. Helderbergs, Albany co. July. S. H. Burnham. East Schaghticoke, Rensselaer co. August.

**Gaura coccinea** Pursh

Near Rochester. August. Introduced from the west. M. S. Baxter and V. Dewing.

**Hydnum coriaceo-membranaceum** Schw.

Ground. Lake Pleasant, Hamilton co.

**Hydnum luteopallidum** Schw.

Decorticated wood and bark of some deciduous tree, apparently butternut, Juglans cinerea. Lyndonville, Orleans co. July. L. J. Muchmore. The type specimens of Schweinitz were found on grapevines. In ours the fungus is resupinate, adnate, with a very thin subiculum, smoky yellow or brownish, whitish or pale yellow on the young margin; the teeth are scarcely half a line long, scattered or crowded, sometimes confluent at the base and subfasciculate, colored like the subiculum but white fimbriate at the tips; spores subglobose, colored, verrucose, .00016–.0002 of an inch broad.

**Hygrophorus burnhami** n. sp.

Ground. West Fort Ann, Washington co. October. The description of this species may be found in the chapter on New York Species of Hygrophorus.

**Hygrophorus luridus** B. & C.

Among mosses and fallen leaves in woods. Sand Lake, Rensselaer co. August.

### **Hypocrea pallida** E. & E.

On some resupinate polyporoid fungus on oak branches. Lake Minnewaska, Ulster co. August.

### **Inocybe pallidipes** E. & E.

Dead wood and decaying vegetable matter, near Friends lake, Warren co. July.

The white stem and brown umbonate pileus are prominent and notable characters of this species. Wood inhabiting species of this genus are few. This one is related to Inocybe eutheloides Pk. but it is a stouter plant with a thicker, straighter stem which is white even in the dried state.

### **Lepiota asperula** Atk.

Woods. Near Ithaca. August. G. F. Atkinson. Vaughns, Washington co. July. S. H. Burnham. This last is a form having a more slender stem and slightly darker pileus, but scarcely worthy of specific distinction.

### **Lepiota eriophora** Pk.

Jamestown, Chautauqua co. August. G. E. Morris. This is distinguished from the preceding species by its smaller size, darker brown color, denser crowded scales of the pileus and specially by the copious brown tomentum of both pileus and stem, a character suggestive of the specific name. It has not yet been found in the eastern part of the State. Its range is apparently westward and southward.

### **Leptoglossum fumosum** Pk.

Geoglossum luteum fumosum, State Mus. Rep't 43. 1890. p. 40.

Receptacle fleshy, stipitate, oblong, obtuse, terete or compressed and furrowed on one or both sides, glabrous, moist, hollow, distinct from the stem and sometimes with one or two decurrent lobes at the base, 3–6 lines long, 1.5–3 lines broad, smoky yellow; stem equal or nearly so, glabrous, hollow, about as long as the receptacle, slightly darker; asci subclavate or cylindric; spores oblong, biseriate, often slightly curved, hyaline, 2–4-nucleate, .0012–.0016 of an inch long, .00016–.0002 broad.

Mossy ground in woods. Sand Lake. August. This was formerly considered a mere variety of Leptoglossum luteum, but having found a group of good specimens showing well the distinctive characters of the species it seems worthy of specific rank.

### **Linum medium** (Planch.) Britton

Hempstead Plains, Nassau co. July.

### **Lycoperdon excoriatum** Lloyd

Warrensburg, Warren co. October. The specimens referred to this species were found growing about the roots of an old stump in a pasture. They are either scattered or gregarious in their mode of growth. The peridium is grayish brown and umbonate and has a cortex similar to that of Lycoperdon gemmatum Batsch but it usually separates and falls away in flakes or patches, a character suggestive of the specific name. Sometimes the larger spinules fall away separately, as in L. gemmatum, leaving a scar on the peridium and showing the close relationship between the two species.

### **Lycoperdon polytrichum Lloyd**

Among hair cap mosses, Polytrichum juniperinum. Piseco, Hamilton co. August and September. Closely related to L. gemmatum, but differing in its peculiar habitat.

### **Lycoperdon serotinum** Bon.

Decaying wood, old stumps and prostrate trunks of trees. September to November. Appearing like a late smooth form of Lycoperdon pyriforme Schaeff.

### **Marasmius phyllophilus** n. sp.

Pileus membranaceous, convex or nearly plane, dry, strongly rugose striate or rugose sulcate, whitish, with a faint pinkish tinge when dry; lamellae narrow, distant, rounded behind, adnexed, white, the interspaces venose; stem tough, slender, equal, inserted, hollow, covered with a whitish downy or velvety pubescence; spores .0002–.00024 of an inch long, .00012–.00016 broad.

Pileus 4–8 lines broad; stem 10–15 lines long, about .5 of a line thick. Gregarious on fallen leaves in woods. Wading River, Suffolk co. August.

Closely related to M. insititius Fr. from which it is separated by the attachment of the lamellae to the stem and by the white color and pubescent coating of the stem. The spores also are larger than the dimensions of the spores of that species.

**Mycena albogrisea** n. sp.

Pileus thin, submembranaceous, ovate or subcampanulate, obtuse, glabrous, sulcate striate, grayish white; lamellae rather thick, broad, distant, adnate, colored like the pileus; stem slender, glabrous, hollow, paler than the pileus, with a whitish strigose villosity at the base; spores .0003 of an inch long, .00016–.0002 broad.

Pileus 3–5 lines broad, nearly as long; stem 1–2 inches long, about half a line thick.

Attached to fallen leaves of coniferous trees. Bolton, Warren co. September. It belongs to the section Basipedes. In the dried specimens the pileus has assumed a slightly darker or smoky tint, but it still retains its sulcate striate character.

**Nicandra physaloides** Gaertn.

Gloversville, Fulton co. September. W. C. Cottrell. Introduced from Peru. The common name of its fruit is apple of Peru. In *Illustrated Flora of the Northern States and Canada* its name is given as Physalodes physalodes (L.) Britton, but the International Botanical Congress having decided against the use of double names, we have used the name given in Gray's *Manual*.

**Omphalia pusillissima** n. sp.

Pileus membranaceous, broadly convex or nearly plane, glabrous, umbilicate, slightly striate on the margin when dry, white; lamellae few, distant, decurrent, white; stem slender, filiform, flexuous, glabrous, white; spores subglobose or broadly elliptic, .0002–.00024 of an inch long, .00016–.0002 broad.

Pileus 1–2 lines broad; stem 3–5 lines long. On humus and decaying twigs under pine trees. Delmar, Albany co. August.

This is one of the smallest species of Omphalia known to me. The lamellae are very narrow, sometimes branched and sometimes absent. It is a smaller mushroom than Omphalia integrella, and differs from it in its umbilicate pileus. The stem is hollow but the cavity is minute.

**Ohleria modesta** Fckl.

On carious wood of beech. Lyndonville, Orleans co. March. C. E. Fairman.

**Panicum deminutivum** n. sp.

Culms 4–10 inches tall, slender, erect, branched, slightly hairy near the base; branches 3–6, short, suberect, each terminating in a

panicle, occasionally bearing one or two branchlets; radical leaves lanceolate, sparingly villose, 3–6 lines long, cauline leaves narrowly lanceolate or linear, acuminate, 6–12 lines long, 1–1.25 lines broad, minutely pubescent beneath, glabrous above, or one or two lower ones sometimes with a few long scattered hairs, the sheaths mostly shorter than the internodes and minutely pubescent, stipules a tuft of slender bristlelike hairs .5–1 line long; panicles ovate in outline, 6–12 lines long, the branches and pedicels glabrous, spikelets subglobose or oval, less than .5 of a line long, the first scale minute, glabrous or nearly so, second and third scales nearly equal in length, minutely pubescent, the second commonly purplish.

Moist or wet muddy soil. Shore of Little pond about 2.5 miles south of Wading River, Suffolk co. August.

This diminutive panic grass has smaller spikelets than any species I find described. In most of its characters it approaches closely to Panicum psammophilum Nash from which I have separated it because of the smaller size of all its parts, its different mode of growth and different habitat. This is wet humus or decomposed vegetable matter which is apparently submerged in times of high water. The mode of growth is scattered, not cespitose, and the pubescence except at the base of the stem is so minute that it is scarcely visible to the naked eye. Unless carefully examined with a magnifying glass the plants would be considered glabrous.

### **Peckiella hymenii** n. sp.

Subiculum white, overrunning the hymenium of the host plant and obliterating the lamellae, sometimes interrupted; perithecia minute, globose, semiimmersed in the subiculum, numerous, pale honey color becoming darker with age; asci linear, .009–.013 of an inch long, .0003–.0004 broad; spores monostichous, fusiform, acute at each end, hyaline, .0016–.0018 of an inch long, .00025–.0003 broad, oozing from the perithecia and forming irregular whitish masses upon them.

On the hymenium of Lactarius vellereus Fr. Wading River, Suffolk co. August.

The parasite in all the specimens seen, is limited to the hymenium of the host plant, the upper surface of the pileus and the stem remaining unchanged. The host plant also retains its acrid taste. The perithecia are so numerous that they give a general pallid hue to the parasite, though the subiculum itself is white. The emitted spores, adhering in minute masses, do not cover the surface with

a white pulverulence as the spores of the related Hypomyces lactifluorum (Schw.) Tul. do.

**Peramium tessellatum** (Lodd.) Rydb.

Woods. Floodwood, Franklin co. North Elba, Essex co. August. This may be separated from Peramium repens (L.) Salisb. by its spiral arrangement of the flowers of the spike.

**Peridermium consimile** A. & K.

Living leaves of spruce trees. Common in the swamps and on the mountains of the Adirondack region where it is associated with Peridermium decolorans Pk. from which it may be distinguished by its smaller spores.

**Phyllosticta ampelopsidis** E. & M.

Living leaves of woodbine, Ampelopsis quinquefolia. Wading River, Suffolk co. August.

**Phyllosticta smilacis** E. & E.

Living leaves of greenbrier, Smilax rotundifolia Mx. Wading River, Suffolk co. August.

**Phyllosticta sphaeropsidea** E. & E.

Living leaves of horse chestnut, Aesculus hippocastanum L. Port Henry, Essex co. September.

**Pleurotus terrestris** n. sp.

Pileus thin, broadly convex, even, glabrous, moist, whitish; lamellae thin, close, broad, slightly emarginate, adnexed, whitish; stem equal, even, curved, glabrous, solid, eccentric, whitish; spores white, globose, .00028–.00032 of an inch broad.

Pileus 2–3 inches broad; stem 2–3 inches long, 3–4 lines thick. Cespitose. On the ground in the margin of woods, West Fort Ann, Washington co. October. S. H. Burnham.

This species belongs to the section Eccentrici, group Tricholomatarii.

**Polyporus galactinus** Berk.

Trunks of apple trees. Delmar, Albany co. August. The fresh young specimens are white, but in drying they assume a pale straw color which in time becomes a dingy yellow. The spores in our examples are subglobose, .00016–.0002 of an inch broad.

**Puccinia peckii** (DeT.) Kell.

On hairy fruited sedge, Carex trichocarpa. North Greenbush. This is the teleutospore form. The aecidial form occurs on living leaves of evening primrose, Onagra biennis (L.) Scop. This form occurs in summer, the other in autumn.

**Russula foetentula** Pk.

The description of this species may be found in the chapter on "New York Species of Russula."

**Russula modesta** Pk.

For description see chapter on "New York Species of Russula."

**Russula pectinatoides** Pk.

The description of this species may be found in the chapter on "Edible Fungi."

**Russula vesca** Fr.

Woods. Bolton Landing, Warren co. August.

**Scleroderma tenerum** B. & C.

This is a small Scleroderma, scarcely attaining a diameter of 1 inch, and having a thin grayish or grayish yellow peridium spotted by very small appressed brownish scales. It is gregarious or sometimes cespitose in its mode of growth. It is not rare, but has been confused with another species both in this country and in Europe.

**Septoria lycopersici** Speg.

Living leaves of tomato. Menands. July. This parasitic fungus produces spots on the leaves and finally discolors the whole leaf and kills it. It is an injurious species.

**Stecchèrinum adustulum** Banker

On dead wood and sticks. Jamestown, Chautauqua co. G. E. Morris. East Schaghticoke, Rensselaer co. July. H. J. Banker. This species differs from the common Hydnum adustum Schw. or its equivalent Steccherinum adustum Banker, in its smaller size and its persistently white or whitish pileus and spines or teeth. Its spores are also a little shorter than in that species.

**Stemonitis smithii** Macb.

Decaying wood. Lyndonville, Orleans co. July. L. J. Muchmore.

**Tricholoma hirtellum** n. sp.

On or about pine stumps. Wading River, Suffolk co. August. The description of this species may be found in the chapter on "Edible Fungi."

**Viola incognita** Brainerd

Damp or moist ground. Little Falls. Mrs M. S. DeCoster. Sand Lake, Rensselaer co. May.

## NEW EXTRALIMITAL SPECIES OF FUNGI

**Phallogaster whitei**

Peridium subglobose, 4–5 lines broad, abruptly contracted below into a cylindric stem about 4 lines long and 1 line thick, stellately or radiately rupturing when mature, the rays recurved; glebe masses greenish, becoming black in drying, separated from each other by a white slightly lobed columella, the lobes not reaching the inner surface of the peridium; spores minute, oblong, .00016–.0002 of an inch long.

Much decayed wood. Storrs, Ct. July. E. A. White. Closely allied to Phallogaster saccatus Morg. but distinct in its smaller size, differently shaped peridium, different mode of rupture, more distinct cylindric stem and different internal structure. Like that species it has an abundance of white branching mycelial strands. It is dedicated to its discoverer.

**Hymenogaster anomalus**

Peridium thin, subglobose, 9–12 lines in diameter, glabrous, slightly lacunose, often with a rootlike strand of mycelium at the base, whitish, sometimes tinged with red above, white and cellular within, the cells empty, .5–1 line in diameter, sterile base obsolete or nearly so, odor slight, not disagreeable; spores globose or broadly elliptic, even, hyaline, uninucleate, .0004–.00055 of an inch long, .00035–.0005 broad.

Near Washington, D. C. August and September. T. E. Wilcox. This species is most closely related to Hymenogaster thwaitesii B. & Br. by its subglobose spores, but it may be separated by its white substance, its smoother colorless spores and

its cordlike strand of mycelium. This last character is unusual in this genus and suggestive of the specific name.

### Leptonia transformata

Pileus thin, submembranaceous, slightly convex or nearly plane, often umbilicate, silky tomentose, dry or slightly moist in wet weather, striatulate on the margin which is at first incurved, sometimes becoming wavy or split when old, white, flesh white, taste farinaceous; lamellae sinuate, adnexed, close, unequal, ventricose, white becoming pink; stem long, slender, straight or flexuose, equal or slightly narrowed upward, pruinose at the top, glabrous and shining below, subcartilaginous, stuffed or hollow, white with a white mycelium at the base; spores flesh colored, angular, uninucleate, .0004–.0005 of an inch long, .0003–.00035 broad.

Pileus 5–10 lines broad; stem 1–2 inches long, .5–1 line thick. Bushy places. Falmouth, Mass. July. S. Davis. Both pileus and stem become blackish or blackish brown in drying and the pileus becomes deeply umbilicate and strongly striate from the margin to the umbilicus. These changes give the dried plant an appearance quite unlike that of the fresh one.

### Hygrophorus ruber

Pileus thin, conic, commonly unexpanded, acute or subobtuse, cuspidate or narrowly umbonate, very viscid or glutinous, bright red, not turning black in drying; lamellae narrow, ascending, adnexed, subdistant, yellow or yellowish brown; stem equal, viscid, hollow, colored like the pileus; spores subelliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus .5–2 inches broad; stem scarcely 1 inch long, 1 line thick. Among mosses in wooded swamps. Ellis, Stow, Cohasset, Mass. September. G. E. Morris.

Distinct from H. conicus in its usually smaller size, more viscid pileus, bright red stem and persistent unchanging color in drying.

### Hygrophorus serotinus

Pileus fleshy but thin, convex or nearly plane, often with the thin margin curved upward, glabrous or with a few obscure innate fibrils, reddish in the center, whitish on the margin, flesh white, taste mild; lamellae thin, subdistant, adnate or decurrent, white, the interspaces slightly venose; stem equal, stuffed or hollow, glabrous, whitish; spores white, elliptic, .0003 of an inch long, .0002 broad.

Pileus 8–15 lines broad; stem about 1 inch long, 1.5–2.5 lines thick.

Gregarious or cespitose in woods of oak and pine. Shore of Hammond pond near Boston, Mass. November. Mrs E. B. Blackford. This species is similar in size and color to Hygrophorus queletii Bres. but that species is described as having the margin of the pileus viscid when young and adorned with white flocci, the center of the pileus covered or spotted with reddish squamules or flocci and at length rimose areolate, the lamellae tinged with citrine yellow, the stem solid and furfuraceous or squamulose and the habitat is said to be larch woods only. None of these characters is applicable to our plant. It also resembles H. subrufescens Pk. in size and color but it differs from it in its more glabrous pileus with paler margin, its white flesh, stuffed or hollow stem and later time of appearance. This last character is suggestive of the name given to the species.

### **Xylaria polymorpha combinans** n. var.

Club subglobose, often compressed and irregular, cespitose at the top of a common subterranean stem or of two stems united at the top; perithecia and spore character as in the species.

Growing from roots of a dead maple tree. Bridgeport, Ct. November. P. W. Graff. The subterranean stem is about 2.5 inches long, the clubs 1–1.5 broad. The clubs appeared as if resting on the ground. The subglobose shape of the club or stroma is characteristic of X. polymorpha hypoxylea Nits. and the cespitose mode of growth, of X. polymorpha spathulata Pers. This combination of characters of two varieties in one is suggestive of the varietal name here given.

## REMARKS AND OBSERVATIONS

### **Agastache scrophulariaefolia** (Willd.) Kuntze

This is a very variable species. A peculiar form occurs near Port Jefferson, in which the leaves are abruptly acuminate or cuspidate and the upper ones are entire or nearly so. The flower spikes are more narrow than usual and are sometimes interrupted toward the base.

### **Boletus nigrellus** Pk.

A form of this extremely rare species was found in Sand Lake in which the pileus is yellowish or greenish yellow when fresh, and

its flesh, as well as the tubes and stem, slowly changes to a dingy flesh color and then to black or blackish where wounded, as in the type.

**Castanea dentata** (Marsh.) Borkh.

There is a chestnut tree near Freehold, Greene co., in which the involucre of the fruit is rudimentary or abortive. It consists of a mere shallow cup or rim which surrounds the base of the fruit. The tree is known to the inhabitants of the place as the burless chestnut. It blossomed freely the past summer but failed to develop fruit. It is said that the boys are so eager for the nuts that the owner of the tree realizes but small returns from it. As it is the only tree of its kind known to us it would seem desirable that it should be perpetuated either by planting its seeds or grafting scions of it on other chestnut trees.

**Catastoma circumscissum** (B. & C.) Morg.

This curious little puffball which ruptures at the base when mature, as indicated by the generic name, is more plentiful in more western regions. It has been found in two localities in our State, one in St Lawrence county, the other in Essex county.

**Chrysomyxa pyrolae** (DC.) Rostr.

As indicated by the specific name, this species usually inhabits the living leaves of various kinds of Pyrola, but the uredo spores were discovered the past season near Friends lake, inhabiting living leaves of Moneses uniflora (L.) Gray. July.

**Clavaria bicolor** Pk.

This name, being antedated by Clavaria bicolor Mass. was changed in *Sylloge* 17, page 196 to Clavaria peckii Sacc. & D. Sacc. This name having previously been used in *Sylloge* 9, page 249, was not available in this case. Therefore the name Clavaria vestitipes is here substituted for Clavaria bicolor in N. Y. State Museum bulletin 54, page 954.

**Craterellus cantharellus** (Schw.) Fr.

A form of this mushroom occurred plentifully the past season near Menands. The hymenium was distinctly marked by branched and anastomosing folds or narrow blunt edged lamellae, so that the plants might easily be mistaken for the common yellow chantarelle.

In the dried specimens the folds have disappeared from the hymenium near the stem but they are very distinct toward the margin. In other respects these mushrooms maintain the characters of the species. We propose for them the name Craterellus cantharellus intermedius n. var. The hymenium is intermediate in character between that of Cantharellus and Craterellus.

### **Dryopteris simulata** Dav.

Fine specimens of this delicate fern were found near "Merrell Avenue," Richmond co. by Mr P. Dowell and contributed by him to the State herbarium.

### **Eleocharis intermedia habereri** Fern.

Sandy shore of Oneida lake at Lewis point, Madison co. August. J. V. Haberer. In this variety the bristles are rudimentary or entirely wanting.

### **Fusarium sclerodermatis** Pk.

This name is antedated by Fusarium sclerodermatis Oud. The New York fungus has the same habitat as the other and is so closely related to it that, in our opinion, it is only a less fully developed form of it.

### **Inocybe calamistrata** Fr.

A form of this species sometimes occurs in which the usual dingy blue tint at the base of the stem is wanting. Such specimens were collected near Friends lake in July. They were growing with the normal form.

### **Irpex canescens** Fr.

Fine specimens of this species were found in woods near Wading River. They were growing on dead branches of an apple tree, and developed on the underside of the branches. On branches less than an inch thick, a free margin projected 3 or 4 lines on each side. The hymenium of these margins had the appearance of the hymenium of some Lenzites, the plates being lamellalike and running at right angles to the axis of the branch and parallel to each other, occasionally branching or anastomosing.

### **Lactarius pergamenus** Fr.

This mushroom seems to intergrade with Lactarius piperatus Fr. Specimens sometimes occur that might with almost equal propriety be referred to either species. But specimens were found

near Wading River in which the prominent distinguishing characters of the species were so well expressed that the identity of the species could be easily recognized. The thin, narrow and very crowded lamellae and the thin and flexible pileus were satisfactorily shown.

**Lobelia dortmanna L.**

In Gray's *Manual* the water lobelia is described as being 5–12 inches high; in Britton and Brown's *Illustrated Flora,* 6-18 inches. Specimens of this plant were collected in Friends lake that are 30–35 inches tall. They grew in deep water which is evidently one factor in determining the length of the stem.

**Lycoperdon pedicellatum** Pk.

On account of the permanently pedicellate spores of this very distinct puffball the species has been transferred from the genus Lycoperdon to Bovistella and bears the name Bovistella pedicellatum (Pk.) Lloyd.

**Panus fulvidus** Bres.

So far as can be ascertained from the descriptions of this species of mushroom and Lentinus sulcatus Berk. they are specifically the same. The uneven or denticulate edge of the lamellae of L. sulcatus is not mentioned in the description of P. fulvidus, but in the other characters there appears to be complete agreement. The specimens which in State Museum bulletin 105, page 26 are referred to P. fulvidus have the eroded or denticulate edge of the lamellae ascribed to Lentinus sulcatus and as this species antedates Panus fulvidus our specimens should take the name Lentinus sulcatus Berk. This species was founded on specimens collected in Ohio.

**Paxillus panuoides** Fr.

A singular form of this species was found at Glens Falls by Dr H. von Schrenk growing on pulp paper that had been stored for a considerable time in an inclosure where there was not much light. Both habitat and place were unusual and evidently had a modifying influence on the character of the specimens. Some of them were 4 inches long, including the narrowed stemlike base, and 2 or 3 inches broad. They were nearly white when fresh but in drying they gradually assumed a yellowish tint approaching the normal

color of the species. Smaller specimens were found growing near these but in a more exposed place. These had the usual color of the species.

**Peziza (Mollisia) typhae** Pk.

This name is antedated by Peziza (Mollisia) typhae Cke. Though bearing the same name the two fungi appear to be quite distinct. In the New York species the cups are superficial and the disk is much paler than in the other and the spores are much smaller. We therefore substitute the name Mollisia pallidior for Peziza (Mollisia) typhae Pk. in New York State Museum Report 32, page 47.

**Physarum lateritium** (B. & R.) Rost.

Bark in woods. Lyndonville, Orleans co. Autumn. Scarce. C. E. Fairman. The Lyndonville specimens differ from the typical form in having the lime granules of the peridium and the nodules of the capillitium yellow instead of red.

**Polystichum acrostichoides incisum** (Gr.) Under.

Pound Ridge, Westchester co. July. Mrs E. S. Tomlinson The specimen is a very broad one, the frond being nearly 6 inches broad in its widest part. The fruiting pinnae are not abruptly reduced in size as in the ordinary form of the species.

**Populus balsamifera** L.

In the town of Sand Lake, Rensselaer co. there is an outlying and unusually southern station of this northern tree, the balsam poplar. The trees are few in number but they have existed there for many years. Those bearing pistillate aments predominate, but staminate aments are borne by at least one tree. The location is so far south of the general range of the species that late frosts often kill the early starting blossoms and prevent the development of fruit. Sometimes when this does not occur the crop of pollen seems to be insufficient for the general pollination of the pistillate blossoms. Last spring many pistillate aments were found with only three or four fruit pods developed, the others having prematurely fallen. The lack of proper pollination was probably the cause.

The leaves on the older and less vigorous branches are somewhat rhomboidal and pointed at both ends, but those on young and vigorous branches are more ovate and broadly rounded or even truncate at the base. Both kinds of leaves grow on different branches of

the same tree. The species is northern in its range and is common in the Adirondack region.

**Sagina procumbens** L.

Crevices of walls and pavements. Utica. September. This is an unusual location for the procumbent pearlwort. Its occurrence here was made known to me by Dr Haberer. It forms rather dense compact mats. In Paine's *Catalogue of Oneida County Plants* its habitat is given as " wet sandy banks and shores." It is recorded as " rare " but no definite station is mentioned.

**Scirpus atrovirens pycnocephalus** Fern.

Shore of Oneida lake at Lewis point, Madison co. August.

**Scirpus cyperinus pelius** Fern.

Open woods 3 miles south of Utica. August. J. V. Haberer. Near Frankfort, Herkimer co. September. C. H. Peck.

**Trametes serialis** Fr.

On pulp paper. Glens Falls. October. H. von Schrenk. The specimens are white throughout and therefore the growth of the present season. The usual habitat in the Adirondack region is dead wood of spruce.

**Trillium erectum album** Pursh

Near Syracuse. May. Mrs L. L. Goodrich. In the contributed specimen the petals are yellowish. This form has been unusually plentiful this year and might easily be considered as good a variety as the form with white petals.

**Viola cucullata** Ait.

A peculiar form of this species occurs in North Greenbush. In it the scapes are about as long as the leaves, the tips of the petals are white or whitish and also the basal angles of some of the leaves.

## EDIBLE FUNGI

**Tricholoma hirtellum** n. sp.

HAIRY CAP TRICHOLOMA

PLATE 105, FIG. 1–5

Pileus fleshy, thin, convex, subumbonate, dry, hairy, pale brown, flesh white, taste mild; lamellae thin, narrow, close, slightly sinuate,

adnexed, minutely floccose on the edge, yellowish white or pallid; stem slender, equal, stuffed or hollow, with a very small cavity, fibrillose or subsquamulose, colored like or a little paler than the pileus; spores subglobose, .00024–.0003 of an inch long, .0002–.00024 broad.

The hairy cap tricholoma grows in tufts or singly on or about pine stumps in Wading River, Suffolk co. and occurs in August. It is a very rare species and has been found but once. It is related to Tricholoma albofimbriatum Trog., from which it is separated by its hairy cap, white flesh and less crowded gills not fimbriate on the margin. The hairs of the cap are often collected in minute tufts giving the cap an appearance similar to that of the brownish caps of the honey-colored armillaria, but unlike that species it never has a collar on the stem. The caps are 1–1.5 inches broad, the stem 2–3 inches long and 2–3 lines thick.

### **Tricholoma nudum** (Bull.) Fr.

NAKED TRICHOLOMA

PLATE 104, FIG. 1–9

Pileus thin, broadly convex, nearly plane or slightly depressed in the center, obtuse or occasionally slightly umbonate, incurved on the thin naked margin when young, pale violaceous or lavender, fading with age and the escape of moisture to a pale grayish brown, often slightly tinged with reddish or yellowish hues, flesh of the young plant tinged with the color of the pileus, becoming white with age, taste mild; lamellae thin, narrow, close, slightly sinuate, adnate or decurrent, colored like the pileus when young, becoming whitish with age; stem firm, equal, fibrous, stuffed or hollow, colored like the pileus; spores pale flesh color in mass, elliptic, .00024–.0003 of an inch long, .00012–.00016 broad.

The naked tricholoma is a rare species with us. The specimens tested and figured on plate 104 were collected in Electric park, Columbia co., October 29, by Mr S. H. Burnham. The plants were found growing in flower beds, either singly or in clusters, and when young and fresh they are throughout of a beautiful violet color approaching lavender, but this color fades and changes with age and with the escape of moisture and the cap becomes a pale pinkish gray or dingy reddish, the stem and gills also changing in a similar manner. The cap is generally obtuse but sometimes umbonate. The margin is very thin and when young is incurved and sometimes

striatulate, the obscure striations being the shadowy lines of the gills showing through the membranous and almost translucent substance of the margin. In drying, the excessive moisture escapes from the center of the cap first. The margin is naked even in young plants and in this character the species differs from its near relative, the masked tricholoma. It is also smaller than that species and more highly colored when young. The naked margin is probably the character which suggested the name of the species. The typical form of the species is described as having a stuffed stem. In our plants the stem is sometimes clearly hollow. An acid odor has been ascribed to the species but no distinct odor was perceptible in our specimens. European mycologists do not appear to have given very definitely the color of the spores of this species. Professor Fries describes the spores of the species referred by him to Paxillus, tribe Lepista, as sordid, and W. G. Smith, who raised this tribe to generic rank and referred both Tricholoma nudum and T. personatum to it, says the spores are dirty white. In our plant the spores are pale flesh color and indicate a close relationship between this species and those of the pink spored series, specially those in the genus Clitopilus. But the close connection between this species and Tricholoma personatum persuades us at present to let the species remain where it has so long stood notwithstanding the peculiar spore color. The cap in our specimens is 1–3 inches broad, the stem 1–2 inches long and 2–4 lines thick.

Stevenson says of the European plant, "Not recommended as edible." Gillet says "very good" and "very delicate" but rarely used. In our trial of it we found it agreeable in flavor, digestible and harmless and have no hesitation in placing it among the edible species. Its worst defect is its scarcity.

## **Clitocybe amethystina** (Bolt.)

### AMETHYST CLITOCYBE

PLATE 106, FIG. 1–6

Pileus at first hemispheric, becoming broadly convex or nearly plane, hygrophanous, often obscurely striate on the margin when young and moist, depressed in the center or frequently umbilicate, often irregular, violaceous when moist, grayish or grayish white when dry; lamellae rather thick, subdistant, violaceous, adnate or slightly decurrent; stem slender, rigid, straight or flexuose, stuffed,

becoming hollow, paler than the moist pileus; spores globose, verrucose, .0003–.0004 of an inch broad.

The amethyst clitocybe is a small species, gregarious in its mode of growth and slightly tough. European mycologists have generally considered it as a mere form or at most a variety of Clitocybe laccata (Scop.) Fr. Berkeley and Broome instituted a new genus, Laccaria, for the reception of C. laccata and allied species with tough substance, hymenophorum confluent with the stem, and thick gills powdered with white globose spores. They remark that the amethyst colored form usually referred to Agaricus laccatus is probably distinct. Their genus has not yet been generally accepted but there is good ground for its establishment and it probably will be recognized in due time. Their remark concerning the amethyst colored form of C. laccata appears to us to be worthy of acceptance and it is therefore accepted here as a distinct species. It is easily recognizable both in its fresh and dried state from the paler and more common form usually referred to C. laccata. It is very constant in its characters and no intermediate forms occur to connect them. It is quite as good as an edible mushroom. In drying, the gills retain their violaceous color longer than the cap.

### **Clitocybe ochropurpurea** Berk.

PURPLISH OCHER CLITOCYBE

PLATE 106, FIG. 7–11

Pileus subhemispheric, becoming convex with a decurved margin or nearly plane and slightly centrally depressed, fleshy, tough, compact, hygrophanous, purplish brown when moist, grayish or pale alutaceous when dry, unpolished; lamellae thick, distant, broad, narrower outwardly, adnate or decurrent, purple; stem variable, short or long, equal, or sometimes thicker in the middle, sometimes at each end, fibrous, solid, colored like or paler than the pileus; spores globose, white, verrucose, .0003–.0004 of an inch broad.

The purplish ocher clitocybe is related to such species as the laccate clitocybe, C. laccata, and the amethyst clitocybe, C. amethystina. From both it is easily separated by its purple gills and larger size. It is found in wet weather from July to September. It grows in open grassy places and is sometimes quite irregular in shape. Its cap is often 3–4 inches broad and its

stem 4–6 lines thick. As an edible species it is rather tough but its flavor is agreeable if well cooked and seasoned and it is harmless.

Should the proposed genus Laccaria be recognized the name of the present species would be Laccaria ochropurpurea (Berk.) and that of the preceding species would be Laccaria amethystina (Bolt.) Cke.

## **Russula compacta** Frost

### COMPACT RUSSULA

PLATE 109, FIG. 1–4

Pileus fleshy, compact, broadly convex, becoming centrally depressed or infundibuliform by the elevation of the margin, dry or slightly viscid after rain, unpolished, at first whitish slightly clouded with reddish buff, or rusty red with whitish margin, becoming entirely rusty red with age, flesh white, taste mild or slightly and tardily acrid; lamellae close, adnate or slightly rounded behind, unequal, some forked, white, changing to reddish brown where wounded and in drying; stem short, stout, firm, solid or sometimes cavernous, white, becoming stained where bruised; spores white, globose or subglobose, .0003–.00035 of an inch broad.

The compact russula is a large mushroom belonging to the Friesian section Compactae. It is allied to the European Russula mustelina Fr. from which it may be separated by its different color, which changes with age, and by its disagreeable odor in drying. The cap is usually 2–4 inches broad, but sometimes it attains a diameter of 6 inches. Its stem is short, equal, stout and firm, white when young but usually becoming colored like the cap. It is 2–2.5 inches long, 8–18 lines thick. It furnishes an abundance of agreeable food, the flesh being so thick and compact.

## **Russula earlei** Pk.

### EARLE RUSSULA

State Mus. Bul. 67, p. 24, pl. N, fig. 5–10.

The Earle russula is a very distinct and easily recognized species. No one of our other species has such distant gills combined with such small white spores. These characters in connection with its very viscid or glutinous and pale yellow or straw colored cap make it scarcely possible to confuse it with any other species. It has hitherto been found on Long Island only. It occurs in August.

## **Russula pectinatoides** n. sp.

PECTENLIKE RUSSULA

PLATE 105, FIG. 6–10

Pileus thin, broadly convex becoming nearly plane or centrally depressed, viscid when moist, widely tuberculose striate on the margin, brownish or yellowish brown, sometimes darker in the center, flesh white, grayish white under the separable cuticle, taste mild or slightly acrid; lamellae thin, a few forked at the base, occasionally a short one, adnate, white becoming pallid; stem equal, spongy within, even, glabrous, white; spores whitish, subglobose, .00025–.0003 of an inch long.

Grassy ground in groves or pastures. The pectenlike russula is similar to Russula pectinata (Bull.) Fr. from which it differs in its mild or slightly acrid flavor, its even stem, in its flesh being grayish white under the cuticle and in its adnate gills. It is gregarious or scattered in its mode of growth and is not plentiful. It closely resembles Russula sororia Fr. in its general appearance, but may be separated from it by its milder taste.

Its cap is 1–3 inches broad; its stem is 1–2 inches long and 3–4 lines thick. It appears in July and August. It is edible but not very highly flavored.

## **Russula uncialis** Pk.

INCH WIDE RUSSULA

PLATE 107, FIG. 7–12

Pileus thin, convex becoming expanded or centrally depressed, viscid when moist, glabrous or very minutely rivulose-granulose, red or pinkish red, the margin obscurely tuberculose striate, flesh white, taste mild; lamellae moderately close, narrowed toward the stem at which a few of them in some specimens are forked, adnate or slightly emarginate, white, the interspaces venose; stem equal, glabrous stuffed or spongy within, white or reddish; spores white, globose, rough, .0003–.00035 of an inch in diameter.

The inch wide russula belongs to the subgenus Fragiles, white spore group. It is about as large as Russula fragilis, but may be distinguished from it by its mild taste and less crowded gills. From similarly colored specimens of R. chameleontina it differs in its white spores and gills. The gills become pallid in drying.

## **Agaricus micromegethus** Pk.

SMALL MUSHROOM

PLATE 107, FIG. 1–6

Agaricus pusillus Pk., N. Y. State Mus. Rep't 54, p. 152.

Pileus fleshy but thin, fragile, convex, becoming plane, sometimes slightly depressed in the center, dry, silky fibrillose or fibrillose-squamulose, grayish brown, darker or brown in the center, often with yellowish or ferruginous stains, flesh white or whitish, not changing color where wounded, taste and odor almond; lamellae thin, close, free, grayish, soon pinkish, finally brown; stem equal or slightly tapering upward, sometimes bulbous, stuffed or hollow, slightly fibrillose, white, the annulus slight, often evanescent; spores broadly elliptic or subglobose, .0002 of an inch long, .00016 broad.

The specimens from which this species was first described were smaller than others collected later. The caps in these now before us are 1–3 inches broad and the stems 1–2 inches long and 3–5 lines thick. The flesh is white and unchangeable when cut or wounded. It has a taste resembling that of almonds which has given origin to the local name "almond mushroom." One correspondent says that "it is the finest flavored mushroom he has ever tasted." Bruises of the cap and stem of the fresh plant sometimes assume a yellow color. The plants grow singly or in clusters. They appear from September to November, and have been found growing in both sandy and clayey soil, and in tan yards. The range is from Michigan to Massachusetts.

## **Boletus frostii** Russell

FROST BOLETUS

PLATE 108, FIG. 1–5

Pileus convex, firm when young, becoming softer with age, glabrous, viscid, dark red becoming paler with age, flesh whitish, tinged with yellow next the tubes, taste slightly acrid; tubes concave in the young plant, becoming plane or convex, adnate, yellowish with their mouths colored like the pileus, changing to bluish green where wounded; stem equal or nearly so, solid, strongly reticulate, colored like the pileus, yellow within, often with reddish stains at the base; spores with a greenish hue when caught on white paper, subfusiform, .0005–.0006 of an inch long, .0002 broad.

The frost boletus is a very showy species. Its deep red cap and distinctly reticulate red stem are attractive to the eyes and a delight

to the mycologist. It occurs in our State on Long Island and so far as known is not found elsewhere within our limits. Its viscid cap is 2–4 inches broad and its stem about as long and 4–6 lines thick. It grows both in thin woods and in open places and occurs during July and August. According to the old rule, which pronounced all species of which the broken flesh assumed a blue color to be unfit for food and dangerous, this species should be rejected. But this rule must have its exceptions. I have eaten of this boletus without harm and one of my correspondents writes that he has eaten four caps of it at a meal and considers it an excellent species.

### **Boletus rugosiceps** Pk.

RUGOSE CAP BOLETUS

State Mus. Bul. 94, p. 20, pl. Q, fig. 6–10.

The rugose cap boletus is well marked by its yellowish ochraceous cap which is irregularly uneven by unequal and variously shaped pits or depressions in its surface. It is sometimes slightly tinged with red or orange and occasionally embellished with small areolae formed by cracks in the surface. The surface is viscid and shining when moist and the flesh is white or whitish. The tubes are at first closed but they soon open, are minute, round and yellow, becoming darker with age. The stem is solid and firm in texture, often marked with elevated longitudinal lines or ridges and dotted with numerous points which are variable in color, being either pallid, brownish or yellowish. The cap is 1–3 inches broad, the stem 2–4 inches long and 4–8 lines thick. The plants grow in thin woods and may be found in August. They have been found on Long Island but not in other parts of the State. In preparing them for the table it is well to peel away the cuticle and the tubes and discard the stem.

## NEW YORK SPECIES OF HYGROPHORUS

### **Hygrophorus** Fr.

Hymenophorum continuous with the stem, descending unchanged into the trama; lamellae acute on the edge, clothed with a hymenium changeable into a waxy mass, not membranaceous; spores globose elliptic or ovoid, white.

Terrestrial putrescent fungi with a viscid or moist pileus.

The waxy character of the hymenium is the chief distinguishing character of the genus. The lamellae are usually thick, distant or subdistant, and their hymenial surfaces somewhat separable from

the trama. Many species with decurrent gills are similar in appearance to species of Clitocybe, but such species may generally be distinguished by their distant lamellae and their viscid pileus and stem. The genus was divided by Fries into three tribes or subgenera which have not yet been accepted as genera but they probably will be in due time. The following synoptic key indicates the prominent characters that may be employed in their separation.

KEY TO THE SUBGENERA

Stem solid or stuffed.......................................................1
Stem hollow.......................................................Hygrocybe
1 Pileus moist, not viscid.......................................Camarophyllus
1 Pileus and stem viscid.......................................Limacium

## Limacium Fr.

Universal veil viscid with a partial floccose veil sometimes forming a ring or attached to the margin of the pileus; lamellae adnate or decurrent; stem clothed with squamules or more often scabrous punctate at the top (or sometimes glabrous).

In this subgenus the pileus and stem are normally viscid but in Hygrophorus purpurascens Fr. and H. capreolarius Kalchb. they soon become dry. The stem is usually solid or stuffed, but in H. eburneus Fr. and H. hypothejus Fr. it often becomes hollow. H. pudorinus Fr. is described as having no veil, but the pileus and stem are viscid. Perhaps the "velum nullum" has reference to the partial floccose veil only. There are several species in which the stem is neither squamulose nor scabrous punctate at the top. In other respects they agree with the description of this subgenus. They are H. fuligineus Frost, H. flavodiscus Frost, H. speciosus Pk., H. subviolaceus Pk., H. hypothejus Fr. and H. lividoalbus Fr. This might justify the formation of a new subgenus for their reception, but since Fries himself has placed several similar European species in his subgenus Limacium, thus practically recognizing this additional character, it has seemed better to extend the characters of the subgenus, as Fries has done in fact though not in words, than to found another subgenus on such a slight difference.

KEY TO THE SPECIES

Pileus white, or white with the center yellowish or brownish.........1
Pileus pinkish, violaceous or red or purple with paler margin...........7
Pileus livid white, cinereous or brown...................................11
1 Margin of pileus with yellow floccose points..................chrysodon
1 Margin of the pileus naked...................................................2

2 Stem hollow when mature ........ 3
2 Stem solid or stuffed, not hollow when mature ........ 4
3 Lamellae white ........ eburneus
3 Lamellae yellow or yellowish ........ hypothejus
4 Lamellae becoming brownish with age or in drying ........ 5
4 Lamellae persistently white or whitish ........ 6
5 Pileus slightly virgate with innate fibrils ........ virgatulus
5 Pileus not fibrillose ........ laurae
6 Stem scabrous punctate at the top ........ rubropunctus
6 Stem glabrous at the top ........ flavodiscus
7 Pileus purple or with purple squamules in the center ........ 8
7 Pileus some other color ........ 9
8 Pileus uniformly colored ........ capreolarius
8 Pileus with purple squamules in the center ........ purpurascens
9 Stem scabrous punctate at the top ........ pudorinus
9 Stem glabrous, naked at the top ........ 10
10 Pileus bright red, fading to yellow on the margin ........ speciosus
10 Pileus pale violaceous ........ subviolaceus
11 Stem naked at the top ........ 12
11 Stem not naked at the top ........ 13
12 Stem solid ........ fuligineus
12 Stem stuffed ........ lividoalbus
13 Stem squamulose at the top ........ limacinus
13 Stem white floccose at the top ........ fuscoalbus

## **Hygrophorus chrysodon** (Batsch) Fr.

GOLDEN TOOTH HYGROPHORUS

Pileus convex or nearly plane, viscid when moist, shining when dry, white with yellow particles or flocci on the margin and sometimes in the center also, flesh white; lamellae distant, decurrent, white, sometimes yellowish on the edge; stem equal or nearly so, stuffed, white with yellow floccose points at the top; spores elliptic, .0003–.00035 of an inch long, .00016–.0002 broad.

Pileus 1.5–3 inches broad; stem 1.5–2.5 inches long, 3–5 lines thick.

Woods and open places. Albany, Columbia and Ulster counties. Not common. September and October.

A beautiful mushroom easily known by the yellow ornamentation of the margin of the pileus, the upper part of the stem and sometimes the edge of the lamellae.

## **Hygrophorus eburneus** (Bull.) Fr.

IVORY HYGROPHORUS

Pileus convex or nearly plane, viscid when moist, slightly pubescent on the margin when young, white, flesh white; lamellae distant,

decurrent, white; stem equal or narrowed at the base, straight or flexuous, stuffed or hollow, viscid, white with white points or squamules at the top; spores subelliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–3 inches long, 2–4 lines thick.

Thin woods and open places. Sometimes cespitose. Lake Mohonk, Ulster co. September and October. It may be distinguished from its near allies by its hollow stem. It is said to be edible but I have not tried it. The viscidity of the stem makes it difficult to pluck from its place of growth and unpleasant to handle.

## **Hygrophorus virgatulus** Pk.

BLACK LINED HYGROPHORUS

State Mus. Rep't 26. 1874. p. 64.

Pileus convex or nearly plane, viscid when moist, minutely streaked with innate blackish fibrils, whitish with a brownish center, flesh white; lamellae distant, arcuate, decurrent, white becoming brownish in drying; stem equal or tapering downward, solid, viscid, white with a few small white floccose scales at the top; spores .0003–.00035 of an inch long, .00016–.0002 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 2–3 lines thick.

Woods. Rensselaer county. October. Very rare. The specimens here described were found in 1872 but no specimens of this species have since been found. The species is closely related to H. laurae from which it may be separated by its smaller size, more dingy color of the pileus with its innate fibrils and by its more soft floccose scales at the top of the stem.

## **Hygrophorus laurae** Morg.

LAURA HYGROPHORUS

Jour. Cinn. Soc. Nat. Sci. 6. 1883. p. 180.

Pileus fleshy, convex, umbonate, becoming expanded and depressed, more or less irregular, glutinous, white with a reddish or brownish tinge, specially on the disk, flesh white; lamellae unequal, adnate or decurrent, distant, white; stem more or less curved or crooked, often tapering downward, solid, yellowish white, the apex scabrous with scaly points; spores elliptic, apiculate, .0003 of an inch long, .0002 broad.

Pileus 2–4 inches broad; stem 2–4 inches long, 3–6 lines thick.

Woods and open places. Common. August and September. Single, gregarious or cespitose.

Var. unicolor Pk. Pileus wholly white or only faintly tinged with yellow. Warren county. September. Edible. In this variety and in the typical form both pileus and lamellae become darker colored with age or in drying, but in the lamellae the change is more pronounced than in the pileus.

Var. decipiens Pk. Pileus thin, white with a dingy yellow or smoky brown spot in the center; lamellae subdistant, stem long, slender, white; pileus and stem not changing color with age or in drying, lamellae changing color slightly. Cespitose; borders of woods. Hamilton county. September. Edible.

More slender than the typical form and differing specially in the persistent colors of the pileus and lamellae. Closely related to the next following species.

### (**Hygrophorus rubropunctus** n. nom.

RED DOTTED HYGROPHORUS

(**Hygrophorus glutinosus** Pk.)

State Mus. Bul. 54. 1902. p. 950.

Pileus fleshy, firm, convex, glutinous, white, sometimes tinged with yellow by the drying of the gluten, involute on the margin, flesh white; lamellae subdistant, adnate, white; stem equal, solid, white, floccose tomentose below the glutinous annulus, studded above with drops of moisture which in drying form reddish glandular dots; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–1.5 inches long, 3–4 lines thick.

Open places. Warren county. September. Rare. In the fresh plant the lower part of the stem appears to be coated with tomentum smeared with gluten, but in the dried plant the gluten assumes an orange-yellow or bright straw color and the tomentum disappears. The species differs from H. laurae Morg. in its white pileus, persistently white lamellae, reddish dots at the top of the stem and in the tomentum of the lower part of the stem. Agaricus glutinosus Bull., in its transfer to the genus Hygrophorus to which it belongs, was consigned to synonymy, therefore according to the rule "once a synonym always a synonym" it becomes necessary to change the name Hygrophorus glutinosus Pk. This has been done by substituting for it the name Hygro-

phorus rubropunctus which has reference to the red dots at the top of the stem.

### **Hygrophorus flavodiscus** Frost

YELLOW DISKED HYGROPHORUS

State Mus. Rep't 35. 1884. p. 134; State Mus. Mem. 3, p. 145, pl. 50, fig. 1–6.

Pileus fleshy, convex or nearly plane, very viscid or glutinous, white, pale yellow or reddish yellow in the center, flesh white; lamellae adnate or decurrent, subdistant, white, sometimes with a slight flesh-colored tint; stem nearly equal, solid, very viscid or glutinous, white at the top, white or yellowish below; spores elliptic, .00025–.0003 of an inch long, .00016–.0002 broad.

Pileus 1–3 inches broad; stem 1–3 inches long, 3–6 lines thick.

Pine woods. Albany county. October. Rare. Edible. This is an excellent edible species, tender and agreeable in flavor. It is well to strip off the viscid pellicle with its adhering dirt and leaves before cooking. The species differs but slightly except in color from H. fuligineus Frost with which it sometimes grows.

### **Hygrophorus capreolarius** Kalchb.

CAPREOLAR HYGROPHORUS

Pileus fleshy, convex becoming plane or centrally depressed, subviscid but soon dry, virgate with innate darker fibrils and punctate squamulose in the center, purplish red, flesh reddish; lamellae narrowed toward each end, distant, adnate or decurrent, purplish with a slight cinnamon tint; stem nearly equal, solid, striate or reticulate with obscure fibrils, purplish brown; spores .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–3 inches broad; stem 1–3 inches long, 3–6 lines thick.

Gregarious or cespitose. Woods, mostly under coniferous trees. Essex county. September.

This was published by Kalchbrenner as a variety of H. erubescens Fr. but in the *Sylloge* it is given as a distinct species and most mycologists recognize it as such at the present time. The spore dimensions given above are from spores of our American specimens.

### **Hygrophorus purpurascens** (A. & S.) Fr.

PURPLISH HYGROPHORUS

Pileus fleshy, convex becoming plane, slightly viscid, soon dry, whitish, variegated in the center with purplish red spots or appressed

squamules; lamellae subdistant, adnate or slightly decurrent, whitish; stem equal, solid, white, roughened by purplish squamules, sometimes with slight traces of a veil near the top; spores .00024 of an inch long, .00016 broad.

Pileus 1.5–3 inches broad; stem 1–2 inches long, 3–6 lines thick.

Gregarious, under pine trees. Albany county. October. Very rare. Found but once. Our specimens differ slightly from the typical form, the pileus being fibrillose rather than squamulose and the lamellae are whitish, not purplish. There is a partial webby veil which forms a slight but mostly evanescent annulus. This species and H. capreolarius are less viscid than the other members of this subgenus here described. The spore dimensions are from American specimens.

### **Hygrophorus pudorinus** Fr.

BLUSHING HYGROPHORUS

State Mus. Bul. 67, p. 41, pl. 83, fig. 1–6.

Pileus fleshy, firm, convex becoming nearly plane, glabrous, viscid when moist, pinkish buff or pale flesh color, flesh white, taste mild; lamellae distant, adnate or decurrent, white; stem equal or pointed at the base, solid, white or whitish, with white points at the top; spores elliptic, .0003–.0004 of an inch long, .00016–.0002 broad.

Pileus 2–4 inches broad; stem 2–5 inches long, 6–10 lines thick.

Gregarious or cespitose. Commonly under spruce or balsam fir trees. Essex county. September. Edible. This is a beautiful species, generally free from the attacks of insect larvae, attractive in appearance and of excellent flavor. It is a first-class edible mushroom. The plant referred to Hygrophorus queletii Bres. in State Museum Report 42, page 23 is now believed to be only a form of this species and it is therefore omitted.

### **Hygrophorus speciosus** Pk.

SHOWY HYGROPHORUS

State Mus. Rep't 29, 1878; p. 43, pl. 2, fig. 1–5. State Mus. Mem. 3, p. 148, pl. 51, fig. 21–28.

Pileus ovate or subconic becoming broadly convex or nearly plane, often with a small blunt or acute umbo, glabrous, very viscid or glutinous, bright red or scarlet when young, or red in the center, yellow on the margin, sometimes fading and becoming wholly yellow, flesh white, pale yellow under the separable pellicle; lamellae dis-

tant, decurrent, white or slightly tinged with yellow; stem rather long, nearly equal, solid, viscid, sometimes slightly fibrillose, whitish or yellowish; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 1–2 inches broad; stem 2–4 inches long, 2–4 lines thick.

Gregarious. Under or near tamarack trees. Albany, Essex and Warren counties. September and October. Edible.

This is a beautiful mushroom but its bright colors fade with age and in drying. The bright red or scarlet usually persists longest in the center. Sometimes the umbo alone remains red. The species is closely related to the European H. aureus Arrh. from which it differs in its place of growth, its solid stem, the absence of any tawny hues and of any vestiges of an annulus. H. bresadolae Quel. and H. lucorum Kalchb. are also closely related European species from which our plant differs in its solid stem and the absence of any annulus. No red color is attributed in the descriptions, to either of the three species mentioned, but H. aureus is sometimes figured with a red center to the pileus.

### **Hygrophorus subviolaceus** Pk.

VIOLET HYGROPHORUS

State Mus. Rep't 53. 1899. p. 842, pl. C, fig. 11–15.

Pileus firm, hemispheric, becoming convex, glabrous, viscid, violaceous when fresh and moist, paler or grayish when dry, flesh white; lamellae arcuate, decurrent, distant, pale violaceous; stem equal or tapering downward, solid, glabrous, white; spores subglobose or broadly elliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–1.5 inches broad; stem, 1–1.5 inches long, 2–4 lines thick.

Damp mucky ground in swamps. Meadowdale, Albany co. October.

This species has been found but once. It is evidently very rare. In drying the specimens become blackish or brown. It is related to H. lacmus Fr. but differs from it in its solid stem, in the color of the lamellae and in having no papilla or umbo on the pileus.

### **Hygrophorus fuligineus** Frost

SOOTY HYGROPHORUS

State Mus. Mem. 3, p. 146, pl. 50, fig. 7–12.

Pileus convex or nearly plane, glabrous, very viscid or glutinous, grayish brown or fuliginous, often darker or almost black in the center; lamellae subdistant, adnate or decurrent, white; stem

equal, solid, viscid or glutinous, white or whitish; spores elliptic, .0003–.00035 of an inch long, .0002 broad.

Pileus 1–4 inches broad; stem 2–4 inches long, 4–8 lines thick.

Pine woods. Albany county. October and November. Edible. Often growing in company with H. flavodiscus and equally esteemed as an edible mushroom. Both occur late in the season. The stem is sometimes brownish at the base.

### **Hygrophorus limacinus** (Scop.) Fr.

SLIMY HYGROPHORUS

Pileus fleshy, convex becoming nearly plane, glabrous, viscid, brownish or smoky brown in the center, paler on the margin; lamellae rather thin, subdistant, adnate or decurrent, grayish white; stem equal, firm, solid, viscid, fibrillose striate, squamulose at the top, colored like the pileus toward the base, paler above; spores .0005 of an inch long, .0003 broad.

Pileus 1.5–2.5 inches broad; stem 1–2 inches long, 4–6 lines thick.

Grassy places. Rensselaer county. September. Rare. Found but once.

### **Hygrophorus fuscoalbus** (Lasch.) Fr.

GRAYISH BROWN HYGROPHORUS

Pileus convex becoming plane, even, glabrous, viscose, brownish becoming cinereous, paler on the margin; lamellae rather thick, broad, subdistant, adnate or decurrent, white; stem equal, solid, dry, white floccose at the top, whitish or brownish; spores .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 1.5–3 lines thick.

Woods. Essex county. September. Rare. The typical form of this species is said to have a subannular floccose veil, a character which is not shown by our specimens. European authors do not agree in the dimensions ascribed to the spores of this species. In our specimens the dimensions of the spores agree with those given in *Sylloge*.

### **Hygrophorus hypothejus** Fr.

SULFUR TINTED HYGROPHORUS

Pileus fleshy but thin, convex becoming plane or centrally depressed, even, virgate, glutinous, variable in color, grayish olive, yellowish olive or brownish, paler after the gluten disappears, flesh

thin with a slight yellow tinge; lamellae distant, decurrent, yellow, or whitish becoming yellowish; stem equal, stuffed or hollow, viscid, paler than the pileus, the partial floccose veil imperfectly annular, soon disappearing; spores .0003–.0004 of an inch long, .00016–.0002 broad.

Pileus 1–2 inches broad; stem 2–3 inches long, 3–5 lines thick.

Woods. Essex county. September. Rare. This species may be distinguished from its nearest relatives by its yellowish lamellae. It is more common southward where it occurs late in the season, growing specially in pine woods.

### **Hygrophorus lividoalbus** Fr.

LIVID WHITE HYGROPHORUS

Pileus thin, convex or nearly plane, often irregular or wavy, even, glabrous, viscid, pallid or livid, naked on the margin; lamellae distant, adnate or slightly decurrent, white; stem slender, nearly equal, glabrous, stuffed, more or less flexuous, whitish; spores subglobose, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–2.5 inches long, 2–3 lines thick.

Woods. Onondaga and Ulster counties. September. Rare. Our specimens do not fully agree with the description of the species in respect to the spore character which is given above, the European plant having larger and more elliptic spores. Further observation may show them to be closely related but distinct species.

### **Camarophyllus** Fr.

Veil none; pileus firm, opaque, moist in rainy weather, not viscose; lamellae distant, arcuate; stem even, glabrous or fibrillose, not punctate scabrous.

The absence of a viscid pileus and of a hollow stem are decisive characters of the subgenus. In wet weather the pileus is only moist, not viscid. The stem is usually solid or stuffed. In a single species, Hygrophorus peckianus Howe, it sometimes becomes hollow.

KEY TO THE SPECIES

| | | |
|---|---|---|
| | Pileus white or whitish | 1 |
| | Pileus brown, grayish brown or blackish brown | 3 |
| | Pileus neither white nor brown | 6 |
| 1 | Pileus more than 1 inch broad | **virgineus** |
| 1 | Pileus usually less than 1 inch broad | 2 |
| 2 | Stem 1–2 lines thick | borealis |

2 Stem more than 2 lines thick..............................pratensis
3 Pileus less than 1 inch broad..................................peckianus
3 Pileus more than 1 inch broad..................................4
4 Pileus glabrous..................................................5
4 Pileus not glabrous.......................................metapodius
5 Pileus blackish brown.....................................burnhami
5 Pileus grayish brown......................................basidiosus
6 Pileus glabrous..............................................pratensis
6 Pileus not glabrous.....................................subrufescens

## Hygrophorus virgineus (Wulf.) Fr.

WHITE HYGROPHORUS

State Mus. Mem. 3, p. 150, pl. 52, fig. 8–12.

Pileus fleshy, convex, often becoming plane or centrally depressed, sometimes irregular or wavy on the thin margin, moist, white, flesh white, taste mild; lamellae thick, distant, decurrent, white; stem firm, smooth, solid, equal or tapering downward, white; spores elliptic, .00024–.0003 of an inch long, .0002 broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–5 lines thick.

It occurs in grassy places in wet weather and may be found from July to October. Albany, Essex and Rensselaer counties. In the European plant the surface of the pileus is said to become floccose when dry and sometimes to crack into small areas, but these characters have not been observed by us in the American plant. It is edible.

## Hygrophorus borealis Pk.

NORTHERN HYGROPHORUS

State Mus. Rep't 26. 1874. Bot. ed. p. 64.

Pileus thin, convex or nearly plane, glabrous, moist, even, sometimes striatulate on the margin; lamellae distant, arcuate, decurrent, white; stem slender, firm, glabrous, straight or flexuous, equal or tapering downward, stuffed or solid, white; spores elliptic, .0003–.00035 of an inch long, .0002–.00024 broad.

Pileus 8–12 lines broad; stem 1–2 inches long, 1–2 lines thick.

Damp or moist ground in woods and swamps, occasionally in pastures. Common in hilly and mountainous regions. July to October. This small white species is closely allied to H. n i v e u s (Scop.) Fr. from which it may be separated by its pileus which is neither viscid nor umbilicate.

## **Hygrophorus pratensis** (Pers.) Fr.

MEADOW HYGROPHORUS

State Mus. Rep't 48, p. 279, pl. 28, fig. 11–17.

Pileus compact, convex, turbinate or nearly plane, often irregular, glabrous, thin on the margin, variable in color, tawny, reddish, buff, cinereous or whitish, flesh white or whitish, taste mild; lamellae thick, distant, decurrent, whitish or yellowish, the interspaces often veiny, stem short, even, glabrous, solid or stuffed, equal or narrowed downward, white or tinged with the color of the pileus; spores .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Scattered, gregarious or cespitose; growing in woods, pastures and grassy places. Common. July to September.

Several varieties of this variable species have been recognized. The names given them are mostly derived from their color. Var. albus. Whole plant white or whitish. Var. cinereus. Whole plant cinereous or the stem only whitish. Var. pallidus. Plant ochraceous white. The plants are edible when cooked.

## **Hygrophorus peckianus** Howe

PECKIAN HYGROPHORUS

Bul. Torrey Bot. Club 5. 1874. p. 43.

Pileus rather thin but firm, convex or slightly depressed in the center, glabrous, hygrophanous, sooty brown when moist, paler or buff brown when dry, the margin often decurved and wavy; lamellae subdistant, thick, arcuate, decurrent, pallid, becoming darker with age; stem slender, glabrous, flexuous, stuffed, sometimes becoming hollow, often narrowed toward the base, colored like the pileus; spores subglobose, .0002–.00024 of an inch long.

Pileus 5–10 lines broad; stem 1.5–2 inches long, 1–2 lines thick.

Gregarious or cespitose. Growing under ferns. Hamilton county. August. The fresh plant emits a peculiar, indescribable odor. It is closely related to the European H. foetens Phil. and may be specifically the same. Its name, however, antedates that of the European plant.

## **Hygrophorus burnhami** n. sp.

BURNHAM HYGROPHORUS

Pileus fleshy, broadly conic becoming convex or nearly plane, moist in wet weather, glabrous or slightly and obscurely innately

fibrillose on the margin, blackish brown, flesh white; lamellae narrow, sometimes forked, subdistant, adnate or slightly decurrent, white; stem equal, sometimes pointed or abruptly narrowed at the base, fibrillose striate, solid, whitish becoming tinged with the color of the pileus, white within and white tomentose at the base; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1.5–3 inches long, 4–6 lines thick.

Gregarious. Growing in mixed woods. West Fort Ann, Washington co. October. S. H. Burnham.

This species is a near ally of H. caprinus (Scop.) Fr. from which it may be separated by its more glabrous pileus, more narrow and closer lamellae, which also are less decurrent. The stem is paler than the pileus and generally slightly radicated at the base and there covered with a white mycelioid tomentum. The lamellae are about 1 line broad.

### **Hygrophorus metapodius** Fr.

CHANGED STEM HYGROPHORUS

Pileus compact, convex becoming nearly plane, often irregular, soon silky and squamulose, brown or grayish brown, flesh thick; lamellae thick, distant, adnate or somewhat decurrent, broadly emarginate, grayish white; stem unequal, sometimes narrowed toward the base, sometimes ventricose, stuffed, glabrous, cinereous, reddish within; spores .0003 of an inch long, .0002 broad.

Pileus 1.5–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods or groves. Ulster county. September. Rare. This species has been found but once. The specimens differ from the typical form in the flesh not becoming red where wounded and no odor was observed at the time of collection.

### **Hygrophorus basidiosus** n. comb.

GRAYISH BROWN HYGROPHORUS

Clitocybe basidiosa Pk. State Mus. Bul. 2. 1887. p. 5.

Pileus rather thin, convex becoming nearly plane or centrally depressed, sometimes umbilicate, glabrous, hygrophanous, grayish brown and striatulate on the margin when moist, grayish white when dry, flesh whitish; lamellae subarcuate, thick, distant, adnate or slightly decurrent, whitish with a violaceous tint; stem equal or slightly thickened at the top, glabrous, firm, solid, whitish or

pallid; spores subglobose, .00016–.0002 of an inch long, basidia .0024 of an inch long, bearing spicules .0003 of an inch long.

Pileus 1–1.5 inches broad; stem 1–2 inches long, 1–2 lines thick.

Woods and swamps. Albany and Rensselaer counties. August.

This species was formerly taken to belong to the genus Clitocybe, but it now appears to be a better Hygrophorus than Clitocybe. It is remarkable for the elongated basidia and sterigmata of the hymenium. It is rare but easily recognized by the peculiar grayish brown hue of the moist plant and the slight violaceous hue of the lamellae.

### Hygrophorus subrufescens Pk.

REDDISH HYGROPHORUS

State Mus. Bul. 67. 1903. p. 23, pl. M, fig. 1–6.

Pileus thin on the margin, convex or nearly plane, dry, minutely floccose or squamulose, pale pink or grayish red, flesh whitish, faintly tinged with pink, taste mild; lamellae subdistant, decurrent, whitish; stem equal or nearly so, flexuous, glabrous, solid or stuffed, white; spores elliptic, .0003 of an inch long, .0002 broad.

Pileus 1–1.5 inches broad; stem 1.5–3 inches long, 2–4 lines thick.

Fallen leaves in woods. Suffolk county. August. Rare. Found but once.

### Hygrocybe Fr.

Veil none; pileus viscid when moist, shining when dry, rarely floccose scaly; lamellae soft; stem hollow, soft, glabrous.

The whole fungus is slender, watery, fragile; many of the species are brightly colored.

A few species without a viscid pileus are included in this subgenus because of their fragility, bright colors and hollow stems. By these characters they may be separated from the subgenus Camarophyllus.

KEY TO THE SPECIES

| | |
|---|---|
| Pileus not viscid | 1 |
| Pileus viscid | 5 |
| 1 Lamellae decurrent | 2 |
| 1 Lamellae not decurrent | 3 |
| 2 Pileus glabrous, pale yellow | parvulus |
| 2 Pileus usually squamulose, red, rarely yellow | cantharellus |
| 3 Pileus brown, sometimes tinged with green or yellow | immutabilis |
| 3 Pileus not brown | 4 |
| 4 Pileus pale yellow | parvulus |
| 4 Pileus golden yellow | marginatus |
| 4 Pileus usually red or orange, rarely yellow | miniatus |
| 5 Stem not viscid | 6 |

5 Stem viscid ........................................ 10
6 Pileus some shade of red ........................................ 7
6 Pileus not at all red ........................................ ceraceus
7 Pileus grayish red or tawny red ........................................ laricinus
7 Pileus bright red, orange or scarlet ........................................ 8
8 Pileus acutely conic ........................................ conicus
8 Pileus not acutely conic ........................................ 9
9 Stem red with a white base ........................................ puniceus
9 Stem red with a yellow base ........................................ coccineus
10 Stem and pileus with greenish slime when young ........................................ 11
10 Stem and pileus not greenish ........................................ 12
11 Lamellae decurrent ........................................ peckii
11 Lamellae adnate ........................................ psittacinus
12 Pileus white ........................................ purus
12 Pileus brown ........................................ luridus
12 Pileus neither white nor brown ........................................ 13
13 Pileus less than 6 lines broad ........................................ minutulus
13 Pileus more than 6 lines broad ........................................ 14
14 Pileus umbilicate ........................................ nitidus
14 Pileus not umbilicate ........................................ 15
15 Lamellae adnexed ........................................ chlorophanus
15 Lamellae adnate or decurrent ........................................ laetus

## **Hygrophorus parvulus** Pk.

SMALL HYGROPHORUS

State Mus. Rep't 28. 1876. Bot. ed. p. 50, pl. 1, fig. 20–24.

Pileus thin, hemispheric or convex, glabrous, striatulate on the margin when moist, pale yellow; lamellae subdistant, arcuate, adnate or decurrent, whitish or pale yellow; stem equal, glabrous, hollow, yellow or pale yellow; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 3–6 lines broad; stem 1–1.5 inches long, 1–1.5 lines thick.

Woods and open places. Common. August.

A noticeable feature in this species is found in the stem which is often more highly colored than the pileus. It sometimes grows under brakes, Pteris aquilina L.

## **Hygrophorus cantharellus** Schw.

CHANTARELLE HYGROPHORUS

State Mus. Rep't 54. 1901. p. 175, pl. 76, fig. 8–20.

Pileus thin, convex, sometimes umbilicate, glabrous or minutely squamulose, red, orange or yellow; lamellae rather broad, distant, arcuate, decurrent, whitish or yellowish, sometimes tinged with red; stem slender, fragile, glabrous, stuffed or hollow, red, orange or

yellow; spores elliptic, .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 6–12 lines broad; stem 1–3 inches long, 1–2 lines thick.

Gregarious. Damp soil in woods or open places. Common. June to August. Edible.

Var. roseus Pk. Margin of the pileus wavy or lobed, the lobes often crowded or overlapping.

Var. flavipes Pk. Pileus red or orange, stem yellow.

Var. flaviceps Pk. Pileus yellow, stem red or reddish.

Var. flava Pk. Pileus and stem pale yellow.

## Hygrophorus immutabilis Pk.

UNCHANGEABLE HYGROPHORUS

State Mus. Rep't 51. 1898. p. 292.

Pileus thin, conic or convex, umbonate, often striate when dry, greenish brown or yellowish brown, not changing color in drying; lamellae subdistant, whitish or yellowish; stem slender, glabrous, hollow, yellow; spores elliptic, .0004–.0005 of an inch long, .00024–.00028 broad.

Pileus 8–12 lines broad; stem 1–2 inches long, 1.5–2 lines thick.

Dry sandy soil in bushy places. Essex county. August. Rare. Found but once.

## Hygrophorus marginatus Pk.

MARGINED HYGROPHORUS

State Mus. Rep't 28. 1876. Bot. ed. p. 50.

Pileus thin, fragile, convex, subcampanulate or nearly plane, often irregular, sometimes broadly umbonate, glabrous, shining, striatulate on the margin, bright golden yellow; lamellae rather broad, subdistant, ventricose, emarginate, adnexed, yellow, sometimes becoming orange or vermilion on the edge, interspaces venose; stem fragile, glabrous, often flexuous, compressed or irregular, hollow, pale yellow; spores broadly elliptic, .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 10–18 lines broad; stem 1–2 inches long, 1–2 lines thick.

Woods. Essex, Fulton and Rensselaer counties. August.

This beautifully colored hygrophorus resembles the European H. obrusseus Fr. in color, but it differs in its smaller size, more subglobose spores and the red color often assumed by the edge of the lamellae. This last character is suggestive of the specific name. It is so fragile that care is necessary to avoid breaking the

specimens when collecting them. Specimens have been received from correspondents that are said to be viscid when fresh and moist, but when received were not distinguishable from our specimens of this species. It is therefore probable that in wet weather this plant may be found viscid.

## **Hygrophorus miniatus** Fr.

VERMILION HYGROPHORUS

State Mus. Rep't 48. 1896. Bot. ed. p. 182, pl. 28, fig. 1–10.

Pileus thin, fragile, convex becoming nearly plane, glabrous or minutely squamulose, often umbilicate, deep red or sometimes yellow; lamellae distant, adnate, yellow, often tinged with red or rarely wholly red; stem slender, glabrous, equal, stuffed or hollow, polished, colored like or a little paler than the pileus; spores .0003 of an inch long, .0002 broad.

Pileus .5–2 inches broad; stem 1–3 inches long, 1–2 lines thick.

Scattered, gregarious or cespitose. Woods and swamps, among mosses and fallen leaves or on bare ground. Common. June to September. Edible.

Var. subluteus Pk. [var. lutescens Pk. State Mus. Rep't 48, Bot. ed. p. 183]. Pileus yellow or reddish yellow; lamellae and stem yellow.

Var. congelatus Pk. [Hygrophorus congelatus Pk. State Mus. Rep't 23, p. 114]. Pileus small, convex, dingy red, glabrous; lamellae subemarginate, red.

Var. sphagnophilus Pk. Pileus subconic or broadly convex, sometimes centrally depressed, glabrous, red or orange; stem colored like or a little paler than the pileus, white or yellow at the base. Growing among peat mosses in bogs. More fragile than the typical form.

The vermilion hygrophorus is a very variable but beautiful species. Unfortunately its colors are apt to fade and its beauty to be lost in drying.

## **Hygrophorus ceraceus** (Wulf.) Fr.

WAXY HYGROPHORUS

Pileus thin, fragile, convex becoming plane, striatulate, viscid, shining, waxy yellow; lamellae broad, almost triangular, distant, adnate or slightly decurrent, pale yellow; stem sometimes unequal and flexuous, hollow, shining, waxy yellow; spores elliptic, .0003 of an inch long, .00016–.0002 broad.

Pileus about 1 inch broad; stem 1–2 inches long, 1–2 lines thick.

Gregarious. Mossy ground or grassy places. Albany, Essex and Ulster counties. September. A small species having very broad lamellae, which are scarcely decurrent. Its waxy yellow color is suggestive of the specific name.

## **Hygrophorus laricinus** Pk.

### LARCH HYGROPHORUS

State Mus. Mem. 3. 1900. p. 146, pl. 51, fig. 1–12.

Pileus thin, convex becoming plane, viscid when moist, grayish red, rusty red or tawny red, sometimes white or yellow on the margin, flesh white, slightly tinged with yellow under the cuticle, taste slightly disagreeable; lamellae distant, adnate or slightly decurrent, whitish; stem equal, firm, hollow, white; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 6–12 lines broad; stem 1–2 inches long, 2–3 lines thick.

Gregarious under tamarack trees. Warren county. October. Rare. Edible. Found but once. The flesh is tender and of good flavor when cooked.

## **Hygrophorus conicus** (Scop.) Fr.

### CONIC HYGROPHORUS

Pileus thin, conic, acute or subacute, fragile, glabrous or fibrillose, viscid when moist, shining when dry, often lobed on the margin, red, scarlet, orange or yellow; lamellae thin, rather close, ventricose, narrowed behind, almost free, commonly yellowish; stem equal, fibrously striate, hollow, yellow; spores broadly elliptic, .0004–.0005 of an inch long, .00024–.0003 broad.

Pileus 6–10 lines high and broad; stem 1–4 inches long, 1–2 lines thick.

Woods and in mossy or grassy places. Common. June to September. This species is easily recognized by the conic shape of the pileus which usually terminates in an acute point. Wounded places in the fresh plant are apt to turn black and the whole plant usually turns black in drying. The color of the pileus is variable and Gillet has published several varieties founded on this character. The viscidity of the cap is slight.

## Hygrophorus puniceus Fr.

RED HYGROPHORUS

State Mus. Mem. 3. p. 149, pl. 52, fig. 1–7.

Pileus thin, fragile, broadly conic or campanulate, becoming nearly plane, often wavy or lobed on the margin, glabrous, viscid, bright red, paler when old; lamellae broad, thick, distant, slightly adnexed, yellow, often reddish; stem equal or slightly ventricose, hollow, glabrous, yellow or red and yellow, white at the base; spores elliptic, .0003–.0004 of an inch long, .0002 broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Damp or mossy places in woods or open ground. Albany and Rensselaer counties and the Adirondack region. Not common. August and September. Edible.

A conspicuous but very tender and fragile mushroom, often larger than our other bright red species of this genus.

## Hygrophorus coccineus (Schaeff.) Fr.

SCARLET HYGROPHORUS

Pileus thin, fragile, convex becoming plane, viscid, glabrous, bright red becoming pale, flesh red; lamellae distant, adnate or furnished with a decurrent tooth, pale yellow or reddish, the interspaces veiny; stem terete or compressed, glabrous, hollow, crimson red above, yellow at the base; spores .0003–.0004 of an inch long, .0002–.00024 broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 1–2 lines thick.

Pastures and mossy meadows. Albany, Ulster and Essex counties. September and October. Not common.

## Hygrophorus peckii Atk.

PECK HYGROPHORUS

Jour. Myc. 8. 1902. p. 114.

Pileus thin, fragile, convex becoming nearly plane, often slightly umbilicate or centrally depressed, very viscid or glutinous, buff becoming pinkish or vinaceous buff, sometimes tinged with green; lamellae broad, distant, arcuate, decurrent, whitish or sometimes greenish when young; stem slender, sometimes splitting longitudinally, very viscid, colored like the pileus, sometimes greenish at the top; spores elliptic, .00024–.0003 of an inch long, .00016–.0002 broad.

Pileus 5–10 lines broad; stem 1–4 inches long, 1–2 lines thick.

Plants scattered or gregarious, often odorous. Woods and open places. Hamilton, Saratoga and Tompkins counties. July and August.

The green color is due to the gluten and it quickly disappears when the gluten dries. The species is closely related to H. psittacinus Fr. from which it may be separated by the pileus which is neither campanulate nor umbonate and by the lamellae which are paler, less ventricose and more decurrent. The plant is very fragile and must be handled carefully to prevent breaking. In color it resembles H. laetus (Pers.) Fr.

## **Hygrophorus psittacinus** (Schaeff.) Fr.

PARROT HYGROPHORUS

Pileus thin, conic or campanulate becoming nearly plane, somewhat umbonate, striatulate, covered when young with an evanescent greenish gluten, yellowish, reddish or whitish; lamellae thick, subdistant, ventricose, adnate, yellow, more or less tinged with green; stem tough, even, hollow, viscid, green at the top, yellow below; spores .0003 of an inch long, .0002 broad.

Pileus 6–12 lines broad; stem 1–2 inches long, 1–2 lines thick.

Pastures, swamps and clearings, often under brakes, Pteris aquilina L. Lewis county. September to November. Rare

The green color is generally more persistent at the top of the stem than elsewhere, both in this and in the preceding species.

## **Hygrophorus purus** Pk.

PURE HYGROPHORUS

State Mus. Rep't 26. 1874. p. 63.

Pileus thin, fragile, conic becoming expanded and cupulate by the upcurving of the thin margin, very viscid, often irregular, white; lamellae subdistant, broad, ventricose, emarginate with a decurrent tooth, white; stem glabrous, subflexuous, fragile, hollow, very viscid; spores .0003 of an inch long, .0002 broad.

Pileus 1–2 inches broad; stem 3–6 inches long, 2–3 lines thick.

Thin woods. Lewis county. September. Rare. Found but once.

H. calyptraeformis niveus Cke. scarcely differs from this. H. calyptraeformis Berk. differs in its beautiful pink or pinkish rose color.

## Hygrophorus luridus B. & C.

LURID HYGROPHORUS

Pileus thin, campanulate or convex becoming nearly plane, umbonate, very viscid, coarsely striate or sulcate striate on the margin, brown or pale brown with a dark center; lamellae thick, distant, ventricose, adnate or slightly decurrent, white; stem slender, hollow, viscid, colored like the pileus; spores .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 6–12 lines broad; stem 1–2 inches long, 1–1.5 lines thick.

Swamps and damp places. Rensselaer, Saratoga and Hamilton counties. July and August. Not before reported from our State.

The type specimens were collected in North Carolina but our northern plant agrees very well with the description of the species except in having no umbo. No spore characters are given in the original description. The dimensions here given are derived from the spores of the northern plant.

## Hygrophorus minutulus Pk.

MINUTE HYGROPHORUS

State Mus. Bul. 2. 1887. p. 9.

Pileus very thin, submembranaceous, convex or expanded, subumbilicate, bright red or orange, viscid, distinctly striatulate when moist, pale red or yellowish when dry; lamellae rather broad, subdistant, sometimes ventricose, adnate or subsinuate and slightly decurrent, whitish tinged with red or yellow; stem short, slender, fragile, solid, viscid when moist, yellowish; spores narrowly elliptic, .0004 of an inch long, .0002 broad, sterigmata .0002–.0003 of an inch long.

Pileus 3–5 lines broad; stem 6–10 lines long, less than .5 of a line thick.

Grassy and mossy places in pastures. Rensselaer county. July. Rare. Found but once.

This is one of our smallest species. Its solid stem does not agree well with the character of the subgenus in which we have placed it, but its bright color indicates its relationship to the species of this subgenus.

### **Hygrophorus nitidus** B. & C.

SHINING HYGROPHORUS

State Mus. Bul. 94. p. 45, pl. 88, fig. 1–7.

Pileus thin, fragile, convex, umbilicate, viscid, pale yellow, shining and striatulate on the margin when moist, whitish when dry; lamellae arcuate, distant, decurrent, pale yellow; stem slender, fragile, viscid, hollow, colored like the pileus; spores .00024–.0003 of an inch long, .0002–.00024 broad.

Pileus 4–12 lines broad; stem 1.5–3 inches long, 1–2 lines thick.

Gregarious or cespitose. Swamps and low damp places. Common. July and August. Edible.

A pretty little mushroom pale yellow throughout, very fragile and very viscid. The yellow color of the lamellae and stem is more persistent than that of the pileus.

### **Hygrophorus chlorophanus** Fr.

SULFURY HYGROPHORUS

State Mus. Mem. 3. p. 147, pl. 51, fig. 13–20.

Pileus thin, fragile, convex becoming nearly plane, often irregular with the margin split or lobed, glabrous, viscid, striate on the margin, pale yellow, sometimes tinged with red in the center; lamellae rather broad, subdistant, thin, ventricose, emarginate, adnexed, pale yellow; stem equal or nearly so, glabrous, viscid when moist, shining when dry, hollow, pale yellow; spores .0003 of an inch long, .0002 broad.

Pileus 8–20 lines broad; stem 1.5–3 inches long, 1–2 lines thick.

Damp or mossy places in woods. Common. July to September. Edible.

### **Hygrophorus laetus** (Pers.) Fr.

PLEASING HYGROPHORUS

Pileus thin, convex, becoming plane, viscid, even or striatulate on the margin, somewhat shining, tawny; lamellae thin, distant, somewhat decurrent, whitish or flesh colored; stem slender, equal, tough, hollow, glabrous, viscid, tawny or pale tawny; spores .00024–.0003 of an inch long, .0002 broad.

Pileus 6–12 lines broad; stem 1–3 inches long, 1–2 lines thick.

Thin woods and pastures. Common. July to September.

When dry the color resembles that of dried specimens of the Peck hygrophorus.

Hygrophorus aurantiacoluteus B. & C., H. cossus (Sow.) Fr. and H. penarius Fr. have been omitted, the specimens formerly referred to these species being doubtful.

## NEW YORK SPECIES OF RUSSULA

### **Russula** Pers.

Veil none; hymenophorum descending unchanged into the vesiculose trama; lamellae rigid, fragile, without a milky juice, acute on the edge; spores globose or subglobose, often echinulate or verrucose, white or yellow.

Fleshy putrescent terrestrial fungi.

This genus is closely related to the genus Lactarius, from which it is easily distinguished by the absence of a milky juice. Young plants of some species have the lamellae, when in vigorous growing condition, adorned with small drops of water, but no milky or colored juice issues from wounds as in species of Lactarius. The pileus is destitute of concentric zones, but in the genus Lactarius such markings are frequent. The red colors which are so conspicuous and common in this genus are rarely if ever seen in Lactarius. In the flavor of the flesh there is great similarity. In both genera many species have a mild or an agreeable flavor and many others have an acrid, hot or peppery taste. This disagreeable flavor is generally destroyed in cooking so that nearly all the species that have been tried have been found to be edible.

The genus was divided by Fries into five tribes or subgenera, but these are not sharply limited and are scarcely satisfactory. Nevertheless we have attempted to group our species as nearly as possible in accordance with them. Some species also are so clearly related to each other that they are liable to be confused unless great care and close observation are exercised. It is important to observe the color of the pileus in both young and mature plants, the character of its surface and its margin, the character and color of the lamellae, the taste of the flesh and the color of the spores. Though the species are numerous their general appearance and form are so peculiar and so much alike that it soon becomes easy to recognize the generic character even in an unknown species.

KEY TO THE SUBGENERA

Margin of the mature pileus even .................................. 1
Margin of the mature pileus striate ................................ 2
1 Lamellae unequal, not often forked ........................ Compactae

1 Lamellae often forked, narrowed toward each end................Furcatae
1 Lamellae often forked, narrowed toward the stem................Rigidae
2 Lamellae unequal, viscid pellicle adnate................Heterophyllae
2 Lamellae mostly equal, viscid pellicle separable...............Fragiles

## **Compactae** Fr.

Pileus fleshy, compact, firm, without a separable pellicle and without striations on the margin; lamellae unequal; stem firm, solid, rarely cavernous when old.

In all our species the spores are white. In nearly all, wounds of the lamellae or flesh change color. Five of the species are so closely related that in the dried state it is scarcely possible to separate them from each other satisfactorily. Their differential characters are chiefly such as can be ascertained only in the living plant. All are mild or tardily acrid in taste. The compact flesh, even margin of the pileus and unequal lamellae are the prominent characters of this subgenus.

KEY TO THE SPECIES

Pileus changing color with age or in drying..........................1
Pileus persistently white or whitish..................................7
1 Pileus becoming smoky brown, grayish brown or blackish..............2
1 Pileus becoming pale tawny or rusty ochraceous.......................6
2 Pileus viscid when moist..........................................3
2 Pileus dry.........................................................4
3 Lamellae and flesh slowly becoming reddish where wounded.....nigricans
3 Lamellae and flesh not becoming reddish where wounded......subsordida
4 Flesh slowly becoming reddish where wounded............densifolia
4 Flesh not becoming reddish where wounded.......................5
5 Flesh becoming black or blackish where wounded.................sordida
5 Flesh not changing color where wounded.........................adusta
6 Pileus viscid when moist, odorous.......................magnifica
6 Pileus dry, inodorous when fresh........................compacta
7 Lamellae persistently white..........................................delica
7 Lamellae becoming subferruginous in drying....................brevipes

## **Russula nigricans** (Bull.) Fr.

BLACKISH RUSSULA

Pileus thick, firm, at first convex and umbilicate with the margin incurved, becoming expanded and centrally depressed, at first white or white clouded with smoky brown, slightly viscid, becoming blackish or blackish brown, flesh white, first slowly changing to a reddish hue when cut or broken then becoming blackish, taste mild; lamellae broad, subdistant, slightly rounded behind, adnexed, white becoming

blackish with age or in drying; stem short, solid, white becoming dingy or smoky brown with age; spores subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and clearings. July and August. Edible.

The dark color of the cooked mushroom gives it an unattractive appearance but its flavor is excellent. This and the following species of which the pileus becomes smoky brown or blackish brown are apt to be infested by the larvae of insects even when quite young. The injury done by them to the flesh causes it to become blackish.

### **Russula subsordida** Pk.

SUBSORDID RUSSULA

State Mus. Bul. 105. p. 40, pl. 99, fig. 1–5.

Pileus firm, convex becoming nearly plane or centrally depressed, glabrous, viscid when young or moist, whitish becoming smoky brown with age, sometimes with an olive-green tint, flesh grayish white, slowly changing to smoky brown when cut or broken, taste mild or slightly and tardily acrid; lamellae thin, close, adnate, whitish becoming black or blackish with age or in drying; stem short, glabrous, solid becoming spongy within and sometimes cavernous, white becoming smoky brown with age or where wounded; spores globose, .0003 of an inch broad.

Pileus 2–5 inches broad; stem 1–1.5 inches long, 6–12 lines thick.

Woods. Warren county. July. Rare. Edible.

Easily distinguished from R. sordida by its viscid pileus. Horicon, Warren co. yet remains the only locality known for this species.

### **Russula sordida** Pk.

SORDID RUSSULA

State Mus. Bul. 105. 1906. p. 39, pl. 98, fig. 1–5.

Pileus convex becoming centrally depressed, dry, glabrous, dingy white becoming smoky brown with age, flesh grayish white, changing to blackish brown or bluish black where cut or broken, taste mild or tardily acrid; lamellae close, unequal, adnate or slightly decurrent, sometimes forked, white changing to black or blackish brown with age or in drying; stem short, firm, equal, solid, colored like the pileus; spores globose, .0003 of an inch broad.

Pileus 3–6 inches broad; stem 1–2 inches long, 6–12 lines thick.

Under hemlock trees. Common in hemlock regions. July. Edible.

From R. subsordida it may be separated by its dry pileus, its more clear white lamellae and by the wounds of the flesh more quickly assuming a blackish color. From R. nigricans and R. densifolia both this and the preceding species may be separated by the absence of reddish hues in the change of color assumed by wounds.

### **Russula densifolia** Secr.

DENSE GILLED RUSSULA

Pileus convex becoming nearly plane or centrally depressed, even, glabrous, whitish becoming gray or sooty brown, sometimes darker in the center, flesh white, slowly changing to reddish and then blackish where wounded, taste mild; lamellae thin, close, adnate or decurrent, white, sometimes tinged with red; stem cylindric, even, solid, slightly pruinose, whitish becoming grayish brown or blackish; spores globose, .0003 of an inch broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 5–9 lines thick.

Woods. Suffolk county and Adirondack mountains. July and August.

Related to R. adusta Fr. from which it is distinguished by wounds of the flesh assuming a reddish color. From R. nigricans Fr. it may be separated by its lamellae being adnate or slightly decurrent and more crowded. Sometimes the lamellae, at their inner extremity, separate from the stem and flesh of the pileus and curve outward and upward. This form appears to be slightly viscid when moist and may prove to be worthy of separation. It is R. densifolia paxilloides Pk. in State Museum bulletin 75, 1904, page 20.

### **Russula adusta** (Pers.) Fr.

SCORCHED RUSSULA

Pileus convex becoming centrally depressed or somewhat infundibuliform, white or whitish becoming brownish or sooty gray, flesh white, not changing color where wounded, taste mild; lamellae thin, narrow, close, adnate or slightly decurrent, sometimes slightly rounded behind, white becoming dingy; stem solid, cylindric, colored like the pileus; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–3 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Albany and Warren counties. July to September. Rare.

The notable characters of the species are its thin, close, adnate lamellae changing color but slightly with advancing age, its unchangeable flesh and its mild taste. The plant does not become blackish in drying as do the preceding species but assumes a smoky brown or grayish brown hue. It sometimes grows under pine needles which it pushes up enough to reveal its place of growth.

### **Russula magnifica** Pk.

MAGNIFICENT RUSSULA

State Mus. Bul. 67. 1903. p. 24, pl. N, fig. 1–4.

Pileus convex and umbilicate becoming centrally depressed or infundibuliform, glabrous, viscid when young and moist, even or sometimes slightly rimose squamose in the center, whitish becoming pale rusty ochraceous, flesh white or whitish, odor and taste alkaline, strong and disagreeable; lamellae narrow, close, adnate or slightly decurrent, whitish with a faint pinkish tint, becoming reddish brown where wounded and a dark reddish brown or reddish cinnamon in drying; stem equal or tapering downward, solid becoming spongy or sometimes cavernous within, white or whitish; spores subglobose, even or nearly so, .0003–.0004 of an inch long, .00025–.0003 of an inch broad.

Pileus 4–10 inches broad; stem 2–5 inches long, 8–18 lines thick.

Among fallen leaves in woods. Suffolk county. August. Local.

A limited locality near Port Jefferson is the only station known to me where this species has been found. It is the largest russula known to me and is related to R. compacta Frost and R. brevipes Pk.

### **Russula compacta** Frost

COMPACT RUSSULA

State Mus. Rep't 32. 1879. p.32; State Mus. Bul. 116. pl. 109, fig. 1–4.

Pileus fleshy, compact, broadly convex, sometimes umbilicate becoming centrally depressed or even infundibuliform by the upcurving of the margin, dry or subviscid after heavy rain, unpolished, at first white or whitish, becoming rusty ochraceous, flesh white, taste mild or sometimes slightly and tardily acrid, odor in drying strong and disagreeable; lamellae rather close or subdistant, adnate or slightly rounded behind, unequal, occasionally forked, white, be-

coming reddish brown where wounded and smoky brown in drying; stem short, stout, equal or nearly so, solid, white, but becoming stained with reddish brown in handling or where wounded, and sometimes changing color like the pileus; spores globose or subglobose, .0003–.0004 of an inch long, .0003 broad.

Pileus 3–6 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Ground in woods. Essex, Onondaga, Rensselaer and Suffolk counties. July to September. Edible.

### **Russula brevipes** Pk.

SHORT STEM RUSSULA

State Mus. Rep't 43. 1890. Bot. ed. p. 20, pl. 2, fig. 5–8.

Pileus convex and umbilicate, becoming centrally depressed or infundibuliform, dry, glabrous or nearly so, white or whitish, often with yellowish or rusty yellow stains or patches in the center, flesh whitish, taste mild or slightly and tardily acrid; lamellae thin, close, adnate or decurrent, rarely slightly rounded behind, white becoming tinged with pale cinnamon or ferruginous in age or in drying; stem firm, solid, glabrous, white; spores globose, .0004–.0005 of an inch broad.

Pileus 3–5 inches broad; stem 1–2 inches long, 6–10 lines thick.

Woods and open places. Common. July to October.

This species exhibits less change of color than any of the preceding ones of this subgenus. The lamellae however change with age and in drying and because of this change, their close position, the unpolished and opaque character of the pileus and the slightly acrid taste I have separated it from R. delica, which it closely resembles and to which our plant was formerly referred. It has been referred by Bresadola to R. chloroides (Krombh.) but I have never seen the pileus rimose areolate, nor the lamellae greenish or glaucous as in that species. The lamellae of both this and the following species are sometimes adorned with watery drops in wet weather. In the type form the stem is very short, but when the plant grows among fallen leaves it is longer.

### **Russula delica** Fr.

WEANED RUSSULA

Pileus fleshy, firm, broadly convex and umbilicate, becoming infundibuliform, even, glabrous, shining, white, the margin involute

and without striations; lamellae thin, distant, decurrent, persistently white; stem short, even, glabrous, white; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 4–6 lines thick.

Woods. Saratoga county. Rare.

The specimens referred to this species have the white color of the lamellae more persistent than in any of the preceding species and the lamellae are less crowded than in the short stem russula. Nevertheless they have a pale yellowish hue in the dried state and are scarcely as wide apart as the description of the species would indicate, but the disagreement is so slight that it is not sufficient cause for a separation of our plant.

## **Furcatae** Fr.

Pileus compact, firm, even on the thin margin, the thin pellicle closely adnate; lamellae unequal, some of them forked, commonly narrowed toward each end.

The thin but even margin with acute edge and the forked lamellae are the notable characters of this subgenus. The lamellae do not show decided changes in color with age or in drying, as in most species of the preceding subgenus. In some species the pellicle is separable on the margin.

KEY TO THE SPECIES

Pileus green, olive-green or purple or these intermingled..............1
Pileus whitish tinged with yellow or reddish yellow.........basifurcata
1 Lamellae becoming yellowish with age........................olivascens
1 Lamellae persistently white or whitish...................................2
2 Lamellae subdistant ......................................furcata
2 Lamellae close, many forked...................................variata

## **Russula basifurcata** Pk

PALE CAP RUSSULA

State Mus. Rep't 38. 1885. p. 90.

Pileus firm, convex, umbilicate, becoming subinfundibuliform, glabrous, slightly viscid when moist, the pellicle separable on the even margin only, dingy white, often tinged with yellow or reddish yellow, flesh white, taste mild, then bitterish; lamellae close, narrowed toward the base, adnate or slightly emarginate, many of them forked at or near the base,, a few short ones intermingled, white becoming yellowish; stem firm, solid, becoming spongy

within, white; spores elliptic, pale yellow, .00035 of an inch long, .00025 of an inch broad.

Pileus 2–3 inches broad; stem 8–12 lines long, 5–6 lines thick.

Dry ground in woods and bushy places. Fulton and Essex counties. July and August.

Closely related to the next following species and like it somewhat related to the subgenus Fragiles in some of its characters.

### **Russula olivascens** Fr.

PALE OLIVACEOUS RUSSULA

Pileus convex or nearly plane, umbilicate, olivaceous or pale green, becoming yellowish in the center, even on the margin, flesh white, taste mild; lamellae narrowed toward the stem, close, slightly adnexed, nearly equal, rarely forked, white becoming yellowish; stem firm becoming spongy within, even, white; spores subglobose, yellowish, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 2–3 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Suffolk county. August.

This species differs from the preceding in the greenish color of the cap, the gills more equal and rarely forked, the absence of a bitterish flavor and in the more globose yellowish spores.

### **Russula furcata** (Pers.) Fr.

FORKED RUSSULA

Pileus convex becoming nearly plane, centrally depressed or infundibuliform, glabrous, the thin pellicle separable on the thin, even, acute margin, varying from pale yellowish green to dark brownish green, sometimes slightly tinged with purple, flesh white, taste mild; lamellae thickish, subdistant, often forked, unequal, adnate or slightly decurrent, white; stem equal or nearly so, solid or spongy within, white; spores white, subglobose, .0003.–.00035 of an inch long, .00025–.0003 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 5–8 lines thick.

Woods. Albany county. July.

The European plant is said to have a mild taste becoming bitterish, and no purplish tints are attributed to the pileus. In our plant the bifurcations of the lamellae occur mostly near the inner and outer extremities. It is thus far limited to a single locality near Albany.

## **Russula variata** Banning

VARIABLE RUSSULA

State Mus. Bul. 105. 1906. p. 41, pl. 101, fig. 1–5

Pileus firm, convex becoming centrally depressed or subinfundibuliform, viscid, even, the thin pellicle separable on the thin even margin, reddish purple or brownish purple, often variegated with green or wholly pea-green, flesh white, taste acrid or sometimes slightly and tardily acrid; lamellae thin, narrow, close, often forked, tapering toward each end, adnate or slightly decurrent, white; stem equal or nearly so, solid or sometimes cavernous, white; spores white, subglobose, .0003–.0004 of an inch long, .0003 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 5–8 lines thick.

Woods. Common and variable. July and August. Edible.

Distinguished from the forked russula by its more forked narrow and closer lamellae and by its acrid flavor. This is destroyed by cooking. The pileus may be dark purple or pinkish purple either wholly or intermingled with pale green or it may be wholly pale green. R. aeruginascens Pk. [State Mus. Rep't 53, p. 843] is a form of this species with yellowish green pileus.

## **Rigidae** Fr.

Pileus compact, firm, commonly dry, without a distinct viscid pellicle, the cuticle often cracking or breaking into adnate scales or furfuraceous granular or mealy particles, the margin typically even, lamellae broader anteriorly causing the margin to appear obtuse.

The most notable character of the group is the dry surface of the pileus becoming squamose, granular, mealy pruinose or unpolished. The margin is commonly even as in the two preceding groups, but there are several exceptions to this. The lamellae are normally forked and unequal, but in a few instances they are nearly equal.

KEY TO THE SPECIES

Pileus green or greenish ........................................ 1
Pileus some other color ........................................ 4
1 Pileus even on the margin ........................................ 2
1 Pileus striate on the margin when mature ........................ crustosa
2 Taste mild ........................................ 3
2 Taste acrid ........................................ viridella
3 Surface of the pileus scaly or warty ........................ virescens
3 Surface of the pileus irregularly rimose on the margin .......... cutefracta

3 Surface of the pileus even, not rimose nor squamose............modesta
4 Stem yellow ...............................................flavida
4 Stem not yellow .............................................5
5 Pileus pruinose, red or purple..................................mariae
5 Pileus not pruinose...........................................6
6 Pileus striate on the margin when mature..................crustosa
6 Pileus even on the margin......................................7
7 Surface of the pileus polished, taste acrid.........................rubra
7 Surface of the pileus not polished, taste not acrid.......................8
8 Surface of the pileus even, dark red or purplish red................9
8 Surface of the pileus often rimose areolate, color variable......lepida
9 Young lamellae white, changing color where wounded............squalida
9 Young lamellae yellow, not changing color where wounded....ochrophylla

## **Russula viridella** Pk.

PALE GREEN RUSSULA

State Mus. Bul. 105. 1906. p. 41, pl. 100, fig. 1–7.

Pileus subglobose, hemispheric or very convex, becoming nearly plane or centrally depressed, even on the margin, dry, soon minutely squamulose or furfuraceous, specially toward the margin, pale grayish green, generally smooth and paler or subochraceous in the center, flesh white, taste acrid; lamellae thin, narrow, close, some of them forked, a few short ones intermingled, white; stem equal or nearly so, even, solid or spongy within, white; spores white tinged with yellow, globose or subglobose, .00024–.0003 of an inch long, nearly as broad, cystidia subfusiform, .0025–.003 of an inch long, .0006 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 5–8 lines thick.

Under hemlock trees. Horicon, Warren co. July. Edible.

It has yet been found in no other locality so far as we know. The acridity is destroyed by cooking.

## **Russula virescens** (Schaeff.) Fr.

GREENISH RUSSULA

State Mus. Rep't 48. Bot. ed. p. 189, pl. 31, fig. 1–8.

Pileus fleshy, at first nearly globose, soon convex or nearly plane often becoming centrally depressed, dry, adorned with small flocculent patches or warts, the margin even, green or grayish green, flesh white, taste mild; lamellae moderately close, narrowed toward the stem, free or nearly so, a few of them forked and a few shorter ones sometimes intermingled, white; stem short, firm, white; spores subglobose, white, .00024–.0003 of an inch long.

Pileus 2–4 inches broad; stem 1–2 inches long, 6–10 lines thick.

Thin woods and in grassy open places. Not rare. July and August. Edible.

The margin of the pileus is usually even but occasionally in old specimens it may be partly striate.

### **Russula cutefracta** Cke.

BROKEN SKIN RUSSULA

Pileus convex becoming centrally depressed, dry, even on the margin, the cuticle cracking somewhat radiately but irregularly on the margin, color variable, green, red or purple, flesh white, purplish under the cuticle, taste mild; lamellae narrowed toward the base, somewhat close, some forked, adnexed or nearly free, white; stem solid, firm, nearly equal, whitish or tinged with purple; spores globose, .0004 of an inch broad.

Pileus 3–4 inches broad; stem 2–3 inches long, 6–10 lines thick.

Woods and their borders. Albany county. October.

I have admitted this species on the strength of a single specimen which agrees very closely with Cooke's figure 1040, illustrating the form with green pileus. Still it differs in having the flesh white instead of pinkish under the cuticle. It must be an extremely rare species with us.

### **Russula crustosa** Pk.

CRUSTOSE RUSSULA

State Mus. Bul. 67. 1903. p. 45, pl. 84, fig. 1–7.

Pileus convex becoming nearly plane or centrally depressed, marked with small appressed areolate scales except on the smooth mostly depressed and sometimes subviscid disk, striate on the margin when mature, color variable, stramineous, pale ochraceous, brownish ochraceous, greenish or greenish yellow, rarely brownish purple, the center sometimes paler, sometimes darker than the margin, flesh white, taste mild or slightly and tardily acrid; lamellae moderately close, narrowed toward the stem, some of them forked, some short, white; stem short, stout, equal, stuffed or hollow, white; spores subglobose, white, .0003–.0004 of an inch long, .00025–.0003 of an inch broad.

Pileus 3–5 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and open places. Common. July and August. Edible.

The striate margin separates this species from all the others in this subgenus. In this it is nearly always present in the mature

plants, in some of the other species it may sometimes appear but it is exceptional. This character militates against the character of the subgenus and connects with the next following one. Sometimes the cuticle cracks on the margin very much as in R. cutefracta but the paler and different colors of the pileus, the white flesh beneath the cuticle and the striate margin easily prevent any confusion of these species. The scales of the pileus often appear as if formed from the breaking up of a crustose cuticle. This sometimes has a grayish appearance.

### **Russula modesta** n. sp.

MODEST RUSSULA

Pileus firm but thin and flexible, broadly convex, becoming nearly plane or centrally depressed, dry, pruinose, even or obscurely striate on the margin, greenish gray, paler on the margin, flesh white, taste mild; lamellae thin, close, many forked at the base, a few short ones, narrowed toward each end, adnate or slightly decurrent, white becoming yellowish, the interspaces venose; stem short, cylindric, solid, glabrous, white; spores subglobose, pale yellowish, .00025–.0003 of an inch long, nearly as broad.

Pileus 1–2.5 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Woods. Albany county. July.

This species differs from its allies in the pruinose appearance of the surface of the pileus. Under a lens, this is seen to be due to a minute whitish tomentose pubescence. A form of this species with the pileus more distinctly green has been received from Miss T. L. Smith who collected it under oak trees and reports it to be edible.

### **Russula flavida** Frost

YELLOWISH RUSSULA

State Mus. Bul. 105. 1906. p. 38, pl. 97, fig. 1–6.

Pileus firm, convex becoming nearly plane or centrally depressed, dry, frequently sprinkled with minute mealy yellowish particles, specially on the margin, pale yellow, sometimes brighter yellow or orange in the center, flesh white, taste mild; lamellae rather thick, moderately close, entire or nearly so, adnate, white; stem equal or slightly tapering upward, solid, sometimes becoming spongy within, occasionally cavernous, colored like the pileus or a little paler, sometimes brighter at the base; spores yellowish, subglobose, .0003 of an inch long, nearly as broad.

Pileus 2–3 inches broad; stem 1.5–3 inches long, 4–8 lines thick.

Woods and bushy places. Rensselaer, Suffolk and Warren counties. July and August. Edible.

The margin of the pileus in old plants sometimes becomes striate and occasionally fades to white. The species is easily recognized by having both stem and pileus yellow and the intervening lamellae white.

## **Russula lepida** Fr.

### SCALY RUSSULA

Pileus firm, compact, convex becoming nearly plane, dry, unpolished, often rimose areolate in part, even on the margin, variable in color, red, bright red, red in the center with yellowish margin or wholly yellow, flesh white, taste mild becoming somewhat acrid or disagreeable; lamellae close, narrowed toward the stem, rounded behind or slightly decurrent, some forked at the base, a few short ones intermingled, white becoming yellowish; stem equal or nearly so, solid, white or whitish, sometimes reddish; spores globose, yellowish, .0003–.0004 of an inch in diameter.

Pileus 2–4 inches broad; stem 1–2.5 inches long, 6–10 lines thick.

Woods. Albany and Suffolk counties. July and August. Not common.

The description here given applies to the American plant, which differs slightly in color from the European. The disk in that species is said in *Sylloge* to always become whitish, a character not yet observed in our plant. In this the disk sometimes is red while the margin is yellow. The lamellae also, in drying, usually assume a subochraceous or pale cinnamon hue, which character is not attributed to the European plant. The edge of the lamellae is sometimes red near the margin of the pileus. The European plant is said to have the stem almost always stained or spotted with red. In ours it is more often white.

## **Russula rubra** Fr.

### RED RUSSULA

Pileus fleshy, hard, rigid, convex becoming nearly plane or centrally depressed, dry, polished, even on the obtuse sometimes wavy margin, very red, almost shining, often darker in the center, flesh white, reddish under the cuticle, taste acrid; lamellae rather close, adnate, broad, unequal, some of them forked, white becoming yellowish with age; stem hard, solid, white or red; spores white, globose or subglobose, .0003–.0004 of an inch long.

Pileus 2-4 inches broad; stem 2-3 inches long, 6-10 lines thick.

Woods. Albany, Madison, Rensselaer and Suffolk counties. July and August.

Distinguished from other members of this subgenus by its smooth polished pileus and its very acrid taste. Var. sapida Cke. (R. atropurpurea Krombh.) is said to be mild in flavor, but otherwise like the species. I have not seen it.

### **Russula squalida** nom. nov.

SQUALID RUSSULA

Russula atropurpurea Pk. State Mus. Rep't 41. 1888. p. 75.

Pileus convex becoming centrally depressed, glabrous, dark purple, often blackish in the center, even or slightly striate on the margin when old, flesh white, grayish or grayish purple under the cuticle, taste mild, odor in drying fetid; lamellae subdistant, a few forked at the base, occasionally a short one intervening, white becoming yellowish, brownish where wounded; stem equal, glabrous, solid or spongy within, white, brownish where bruised; spores pale ochraceous with a salmon tint, subglobose, .0003-.0004 of an inch long, nearly as broad.

Pileus 3-4 inches broad; stem 2-3 inches long, 5-8 lines thick.

Margin of woods. Saratoga county. July.

In the dried state this russula has a peculiar dingy and unattractive appearance. It is very distinct in the unusual color of the spores and the brownish hue assumed where wounded. Agaricus atropurpurea Krombh. being a species of Russula, it becomes necessary to give a new name to the plant to which this specific name was formerly applied by me.

### **Russula ochrophylla** Pk.

OCHERY GILLED RUSSULA

State Mus. Rep't 50. 1897. p. 100; State Mus. Mem. 3. 1900. p. 150, pl. 54, fig. 8-14.

Pileus firm, convex becoming nearly plane and umbilicate or centrally depressed, dry, unpolished, even on the margin, dark red or purplish red, often a little darker in the center, flesh white, red under the adnate cuticle, taste mild; lamellae subdistant, adnate, nearly entire, a few forked at the base, yellowish becoming bright ochraceous buff, dusted by the spores, the interspaces somewhat venose; stem equal or nearly so, solid or spongy within, reddish

but paler than the pileus; spores bright ochraceous buff, globose, .0004 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–2.5 inches long, 6–10 lines thick.

Ground under oak trees. Albany county. July. Rare. Edible.

There is a var. albipes Pk. in which the pileus is deeper red and the stem white. If this mushroom is stewed in milk or cream without peeling, it imparts a pinkish purple hue to the liquid.

## **Russula mariae** Pk.

MARY RUSSULA

State Mus. Rep't 24. 1872. p. 74; State Mus. Bul. 75. 1904. p. 29, pl. 85, fig. 1–8.

Pileus nearly hemispheric becoming broadly convex, plane or centrally depressed, dry, pruinose or minutely pulverulent, dark crimson or purplish, sometimes darker in the center than on the margin, rarely striate on the margin when old, flesh white, pinkish under the cuticle, taste mild or slightly and tardily acrid; lamellae rather close, adnate, white becoming yellowish with age; stem equal, solid or slightly spongy within, colored like or a little paler than the pileus, usually white at each end, rarely entirely white; spores pale yellow, globose, .0003 of an inch broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–5 lines thick.

In woods and in open places. Common. July and August. Edible.

This species is easily distinguished by its pruinose or minutely granular cap. When moistened and rubbed on white paper it communicates reddish stains to it. A few of the lamellae are forked at the base. The pileus sometimes fades with age, specially in purplish specimens, and on the margin. Such specimens resemble Russula depallens (Pers.) Fr. as shown in Cooke's figure 1021.

Russula lactea (Pers.) Fr. is omitted; the specimens referred to it belong to Russula albella Pk.

## **Heterophyllae** Fr.

Pileus fleshy, firm, with a thin viscid adnate pellicle and a thin, usually striate margin; lamellae unequal, some of them forked; stem stout, solid, spongy within.

The viscid pileus and striate margin separate this tribe from the preceding one; the firm pileus, adnate pellicle and unequal lamellae

separate it from the following one. Fries included in it a few species with the margin of the pileus even or obscurely striate.

KEY TO THE SPECIES

| | |
|---|---|
| Pileus even or but slightly striate on the margin | 1 |
| Pileus distinctly striate on the margin | 4 |
| 1 Taste mild | 2 |
| 1 Taste acrid | consobrina |
| 2 Lamellae distant | earlei |
| 2 Lamellae close | 3 |
| 3 Lamellae broad, rounded behind, white | cyanoxantha |
| 3 Lamellae rather narrow, whitish | vesca |
| 4 Pileus brown or brownish | sororia |
| 4 Pileus yellowish, reddish yellow or subochraceous | 5 |
| 5 Pileus roughened with granules | granulata |
| 5 Pileus smooth | 6 |
| 6 Pileus stramineous or subochraceous | foetens |
| 6 Pileus reddish yellow | foetentula |

## Russula vesca Fr.

EDIBLE RUSSULA

Pileus fleshy, rather firm, nearly plane or centrally depressed, viscid, venosely rugulose or radiately wrinkled with a spreading, even margin, reddish or flesh color, darker in the center, flesh white, taste mild; lamellae thin, close, adnate, unequal, whitish; stem solid, compact, rigid, white; spores globose, white, .0003–.0004 of an inch broad.

Pileus 2–4 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods. Warren county. August. Rare.

The species may easily be recognized by the minutely radiately wrinkled or rugulose character of the upper surface of the pileus. The wrinkles or veins commonly radiate toward the margin but they often anastomose in a reticulate manner. In the typical form the pileus is pinkish or red flesh color. In our specimens it is mostly greenish, but darker or blackish green in the center where it is also in some specimens varied with reddish or brownish red hues. The European plant is edible as indicated by the name. I have not tested our plant.

## Russula cyanoxantha (Schaeff.) Fr.

YELLOWISH BLUE RUSSULA

Pileus compact, convex becoming centrally depressed or subinfundibuliform, viscose, variable in color, even on the margin or

sometimes becoming slightly striate, purplish, lilac or olive-green, commonly becoming paler or yellowish in the center, flesh white, taste mild; lamellae broad, moderately close, rounded behind, pure white; stem spongy within, even, glabrous, white; spores subglobose, .0003–.0004 of an inch long, .00024–.0003 broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 5–8 lines thick.

Woods. Albany and Washington counties. July. Not common.

The pileus is sometimes bluish on the margin and yellowish in the center, a character suggestive of the specific name, but not represented in any of our specimens. The flesh is sometimes reddish under the cuticle. The stem may become hollow in old specimens.

### Russula earlei Pk.

EARLE RUSSULA

State Mus. Bul. 67. 1903. p. 24, pl. N, fig. 5–10.

Pileus fleshy, firm, hemispheric becoming broadly convex or nearly plane, sometimes centrally depressed, glabrous, very viscid, the margin even, stramineous becoming paler with age, flesh whitish or yellowish, taste mild; lamellae thick, distant, adnate, a few short, whitish becoming yellowish; stem short, firm, equal or nearly so, solid, becoming spongy within, white; spores white, subglobose, .0002–.00024 of an inch long.

Pileus 1.5–2.5 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Among fallen leaves in woods. Suffolk county. August.

This species is well marked by its pale and glutinous pileus, its distant lamellae and its small spores.

### Russula consobrina Fr.

COUSIN RUSSULA

Pileus fleshy, convex or subhemispheric becoming centrally depressed, viscid, even on the membranaceous margin, gray, olive-brown or umber, flesh white, ashy gray under the pellicle, taste acrid; lamellae close, adnate, many forked and many short, white; stem firm, equal, spongy within, white becoming dingy or cinereous with age; spores white, subglobose, .0003–.0004 of an inch long, nearly as broad.

Pileus 2–4 inches broad; stem 1–3 inches long, 4–10 lines thick.

In woods. Otsego county. July. Rare.

Some of our specimens differ from the description in having a yellowish brown pileus.

### **Russula sororia** Fr.

SISTER RUSSULA

Pileus convex becoming nearly plane, viscid when moist, striate on the thin margin, gray, grayish brown, olive-brown or yellowish brown, often darker in the center, flesh whitish, taste acrid; lamellae narrow, subdistant, adnate, many of them short, rarely forked, whitish or pallid, the interspaces venose; stem equal or slightly tapering upward, white; spores globose, white, .0003 of an inch broad.

Pileus 1–2.5 inches broad; stem 1–2 inches long, 4–8 lines thick.

Woods and groves. Albany and Suffolk counties. July to September.

Similar in color and character to R. consobrina Fr. of which it is thought by some to be a variety, but it is easily distinguished by its distinctly striate margin. R. pectinatoides Pk. resembles this in color but it may be distinguished from it by its mild or tardily and slightly acrid taste and its nearly equal lamellae.

A form with the pileus darker brown, flesh cinereous under the cuticle and stem becoming cinereous was found under chestnut trees near Gansevoort, Saratoga co. It is referable to R. consobrina intermedia Cke.

### **Russula granulata** Pk.

GRANULATED RUSSULA

State Mus. Rep't 53. 1900. p. 843.

Pileus convex becoming nearly plane or centrally depressed, viscid when moist, rough with minute granules or squamules, tuberculate striate on the margin, dingy ochraceous or dingy yellow, tinged with red or brown, flesh white or whitish, taste acrid; lamellae thin, close, adnate, many forked at the base; stem equal or abruptly contracted at the top, glabrous, spongy within, whitish; spores white. subglobose, .0003 of an inch broad.

Pileus 2–3 inches broad; stem 1–1.5 inches long, 6–8 lines thick.

Woods. Ulster and Hamilton counties. August.

In State Museum Report 39, page 57 this was regarded as a variety of R. foetens Fr. from which it differs in its granular pileus, its closer and more narrow lamellae and in the absence of

odor. From R. granulosa Cke. it may be separated by its glabrous stem, smaller spores and adnate lamellae. R. granulata lepiotoides Atk. is a variety having the surface of the pileus rimose squamose.

## **Russula foetens** (Pers.) Fr.

### FETID RUSSULA

Pileus fleshy, fragile, subglobose or convex becoming plane or centrally depressed, viscid when moist, widely tuberculose sulcate or striate on the very thin margin, yellowish or dingy ochraceous, flesh pallid, taste acrid, odor strong, amygdaline; lamellae rather close, adnexed, unequal, some of them forked, whitish and often studded with drops of moisture when young, becoming yellowish with age, dingy where bruised, interspaces venose; stem short, stout, stuffed becoming irregularly hollow, white or whitish; spores white, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Woods and bushy places. Common. July to September.

Readily recognized by its peculiar odor, acrid taste and widely striate margin. Gregarious in habit and somewhat variable in color.

## **Russula foetentula** n. sp.

### SLIGHTLY FETID RUSSULA

Pileus thin, nearly plane, viscid, glabrous, striate on the margin, reddish yellow, flesh white, taste tardily acrid, odor like that of almonds; lamellae thin, narrow, close, adnexed or nearly free, whitish, the interspaces venose; stem equal, firm, cavernous, white or yellowish white, usually spotted or stained with reddish brown at the base; spores very pale yellow, globose, .0003–.00035 of an inch broad.

Pileus 1.5–3 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Among fallen leaves in woods. Suffolk county. August.

This species is related to R. foetens Fr., to which it is similar in odor but from which it differs in its closer lamellae and reddish brown or burnt sienna color at the base of the stem.

The specimens reported in State Museum Report 35, page 135 under the name Russula heterophylla Fr. are doubtful and the species is therefore omitted.

### Fragiles Fr.

Pileus fragile, covered with a thin separable or subseparable pellicle, viscid when moist, thin on the margin which is commonly striate or tuberculose striate in the mature plant; lamellae equal or nearly so, broader anteriorly; stem soft, spongy or hollow.

The fragile character of the pileus, the viscid separable pellicle, the thin and ultimately striate or tuberculose striate margin and the usually equal simple lamellae are the prominent distinguishing features of this subgenus. Its species outnumber those of any other subgenus of Russula. They may be divided into three groups depending on the color of the spores, which color is frequently indicated by the color of the mature lamellae. There are some exceptional or anomalous cases in which all the characters attributed to this tribe are not shown by species included in it. In some species the pileus is not viscid or the margin is not striate or the pellicle may be separable on the margin but not on the disk. The tuberculose character of the marginal striations is apparently due to the venose interspaces.

KEY TO THE SPECIES

Spores white or whitish........1
Spores pale yellow or citrine........10
Spores ochraceous........20
1 Pileus red or reddish........2
1 Pileus ochraceous or yellowish brown........7
1 Pileus white or whitish........8
2 Taste acrid........3
2 Taste mild........6
3 Pileus even........4
3 Pileus rugulose........rugulosa
4 Pileus darker colored in the center........fallax
4 Pileus typically uniformly colored........5
5 Lamellae rounded behind, subfree, subdistant........emetica
5 Lamellae adnexed, close........fragilis
6 Stem white or reddish........uncialis
6 Stem red or deep red........purpurina
7 Stem white........pectinatoides
7 Stem pale ochraceous........simillima
8 Taste acrid........anomala
8 Taste mild........9
9 Pileus dry........albella
9 Pileus viscid........albida
10 Pileus red or some shade of red........11
10 Pileus some other color........17
11 Taste acrid........veternosa
11 Taste mild or slightly and tardily acrid........12

12 Lamellae distant ........................................ integra
12 Lamellae close ........................................ 13
13 Pileus more than 1 inch broad ........................................ 14
13 Pileus less than 1 inch broad ........................................ pusilla
14 Stem and flesh becoming cinereous ........................................ 15
14 Stem and flesh not becoming cinereous ........................................ 16
15 Pileus red or orange ........................................ decolorans
15 Pileus violaceous, purple or dark red ........................................ obscura
16 Stem white, often with reddish stains ........................................ palustris
16 Stem white with yellowish stains ........................................ puellaris
17 Lamellae distant ........................................ integra
17 Lamellae close ........................................ 18
18 Pileus yellow, even on the margin ........................................ lutea
18 Pileus yellow, striate on the margin ........................................ 19
19 Stem white becoming cinereous ........................................ constans
19 Stem persistently white ........................................ flaviceps
20 Stem tinged with red by minute red granules ........................................ roseipes
20 Stem not adorned with red granules ........................................ 21
21 Pileus distinctly striate on the margin ........................................ 22
21 Pileus slightly striate when old ........................................ 23
22 Lamellae pale yellow when mature ........................................ abietina
22 Lamellae ochraceous when mature ........................................ turci
23 Plant small, lamellae very close ........................................ chamaeleontina
23 Plant large, lamellae subdistant ........................................ alutacea

## Russula emetica Fr.

### EMETIC RUSSULA

Pileus fleshy, firm becoming fragile, convex becoming plane or centrally depressed, glabrous, viscid when moist, striate sulcate on the margin, rosy or blood-red, sometimes white or fading to white, flesh white, reddish under the separable pellicle, taste very acrid; lamellae equal, broad, subdistant, rounded behind and free or nearly so, white; stem solid or spongy within, elastic when young, becoming fragile, even, white or tinged with red; spores white, globose, .0003–.0004 of an inch broad.

Pileus 2–4 inches broad; stem 1.5–3 inches long, 3–6 lines thick. Woods and swamps. Common. July to September.

This russula has a very acrid or peppery taste and is generally considered poisonous by European mycologists, but deemed edible and harmless by some American mycophagists. Thorough cooking probably destroys its harmful properties. I have not tried it.

### **Russula rugulosa** Pk.

RUGULOSE RUSSULA

State Mus. Rep't 54. 1901. p. 179, pl. 72, fig. 12–18.

Pileus rather thin, fragile, convex becoming nearly plane or centrally depressed, viscid when moist, uneven with small tubercles and wrinkles, even on the margin when young, becoming tuberculose striate with age, the viscid pellicle separable on the margin, flesh white, reddish under the pellicle, taste acrid or tardily acrid; lamellae moderately close, adnate or slightly rounded behind, white; stem nearly equal, spongy within, white; spores white, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 2–4 inches broad; stem 2–3 inches long, 4–8 lines thick.

Woods among mosses and fallen leaves. Franklin county. August and September. Edible.

Most closely allied to R. emetica Fr. from which it is distinguished by its rugulose pileus and less acrid or tardily acrid taste. The slight acridity is dispelled in cooking and it affords a harmless, tender and agreeable food. From R. vesca Fr. it may be distinguished by its tardily acrid taste and its striate margin.

### **Russula fallax** (Schaeff.) Sacc.

FALLACIOUS RUSSULA

Pileus thin, fragile, convex or nearly or quite plane, viscid when moist, reddish with a darker center, flesh white, taste acrid; lamellae thin, adnexed, distant, whitish or pallid; stem slender, subequal, white; spores white, subglobose, .0003 of an inch long.

Pileus 1–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Moist places. Not rare. August.

This is R. emetica var. fallax Cke. and R. fragilis var. fallax Massee. We have followed Saccardo in recognizing its specific validity. In our specimens the lamellae appear to be less distant than in the typical form, but in other respects the agreement is good.

### **Russula fragilis** (Pers.) Fr.

FRAGILE RUSSULA

Pileus very thin and fragile, convex becoming plane or slightly depressed in the center, with a thin pellicle somewhat viscid when moist, sometimes umbonate, tuberculose striate on the margin, polished, variable in color, typically pale red, sometimes fading to white,

flesh thin, white, not red under the separable pellicle, taste acrid; lamellae thin, close, adnexed, ventricose, sometimes slightly uneven or eroded on the edge, white; stem slender, spongy within or hollow, white; spores white, subglobose, .0003–.0004 of an inch long.

Pileus 1–2 inches broad; stem 1–1.5 inches long, 3–5 lines thick.

Woods and swamps. Not rare in hilly and mountainous wooded districts. July and August.

Var. nivea (Pers.) Cke. Whole plant white from the first. Rainbow, Franklin co. August.

The species is closely allied to R. emetica Fr. from which it may be separated by its smaller size, paler color, thinner flesh, white under the pellicle, and closer lamellae.

### **Russula uncialis** Pk.

INCH WIDE RUSSULA

State Mus. Bul. 2. 1887. p. 10; State Mus. Bul. 116. pl. 107, fig. 7–12.

Pileus thin, convex becoming plane or centrally depressed, viscid when moist, glabrous or very minutely granulose, red or pinkish red, obscurely tuberculose striate on the margin, flesh white, taste mild; lamellae moderately close, narrowed toward the stem near which a few of them are forked, adnate or slightly emarginate, white becoming pallid, the interspaces venose; stem equal, glabrous, stuffed or spongy within, white or reddish; spores white globose, .0003–.00035 of an inch broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 2–4 lines thick.

Woods. Rensselaer county. June and July. Rare.

It is unusual to find a red capped, white spored species of this subgenus with a mild taste. This and the next following species are our only examples of this kind.

### **Russula purpurina** Q. & S.

PURPURINE RUSSULA

Pileus fleshy, fragile, subglobose becoming plane or slightly depressed in the center, sometimes cup-shaped by the upcurving of the margin, with a separable pellicle, acute and even or nearly so on the margin, deep red, flesh white, reddish under the pellicle, taste mild; lamellae moderately close, subequal, a little narrowed behind, white becoming yellowish with age or in drying; stem rather long, cylindric or sometimes slightly tapering above or below, stuffed or

spongy within, colored like the pileus or a little paler, sometimes whitish at the base; spores white, globose or subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1.5–3 inches broad; stem 2–3 inches long, 4–6 lines thick.

Woods. Adirondack region. August and September.

The brilliant red color of the pileus and stem make this one of our most beautiful and attractive species of russula. The lamellae have a few short ones intermingled and the edge often appears floccose under a lens and red near the margin of the pileus. Pointed cystidia are numerous.

## **Russula pectinatoides** Pk.

PECTENLIKE RUSSULA

PLATE 105, FIG. 6–10

Pileus thin, broadly convex becoming nearly plane or centrally depressed, viscid when moist, widely tuberculose striate on the margin, dingy straw color, brownish, yellowish brown or cinereous brown, sometimes darker in the center, flesh white, grayish white under the separable pellicle, taste mild or slightly and tardily acrid; lamellae thin, equal or with an occasional short one, some forked at the base, adnate, white becoming pallid; stem equal or nearly so, even, glabrous, spongy within, white; spores whitish, subglobose, .00025–.0003 of an inch long, nearly or quite as broad.

Pileus 1–3 inches broad; stem 1–2 inches long, 3–4 lines thick.

Grassy ground in groves and woods. Albany and Suffolk counties. July and August.

Specimens of this species were formerly reported as R. pectinata Fr. from which it seems best to separate them as they differ in their milder taste, the grayish color of the flesh under the cuticle, the adnate lamellae and the even stem. From R. sororia Fr. the species differs in its milder taste. In the character of the lamellae it is related to that species and might with almost equal propriety be placed in the same subgenus with it. It is edible.

## **Russula simillima** Pk.

VERY SIMILAR RUSSULA

State Mus. Rep't 24. 1872. p. 75.

Pileus hemispheric or convex becoming plane or slightly depressed in the center, viscid when young or moist, striate on the

margin when mature, pale ochraceous, sometimes more highly colored in the center, flesh white, taste acrid; lamellae nearly equal, some forked near the stem, broader anteriorly, yellowish; stem equal or slightly tapering upward, spongy within, rarely hollow, colored like the pileus or a little paler; spores white, globose or nearly so, .0003 of an inch broad.

Pileus 1–3 inches broad; stem 2–3 inches long, 4–9 lines thick.

Woods. Adirondack region. August and September.

Related to R. ochroleuca (Pers.) Fr. and R. claroflava Grove but differing from both in having the stem pale ochraceous. It may be separated from R. ochracea (A. & S.) Fr. by its acrid taste and white flesh and spores. From R. fellea Fr. which it most closely resembles, the similarity justifying the specific name, it scarcely differs except in having the lamellae and stem pale ochraceous from the first, and the flesh white.

## **Russula anomala** Pk.

ANOMALUS RUSSULA

State Mus. Rep't 50. 1897. p. 99.

Pileus thin, fragile, nearly plane or slightly depressed in the center, dry, striate on the margin, white, sometimes tinged with yellow, flesh white, taste acrid; lamellae thin, moderately close, adnate, equal or with an occasional short one, white, dusted with the white spores when dry; stem equal, solid or spongy within, white; spores subglobose, .0003–.00035 of an inch long, nearly or quite as broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 3–4 lines thick.

Damp ground under trees. Suffolk county. July. Rare.

The anomalous character of this species is found in the pileus which is destitute of the viscid separable pellicle characteristic of this subgenus. Notwithstanding the absence of this character, the fragile pileus with its thin striate margin and the nearly equal lamellae point to this as its proper place in the genus. From R. fragilis nivea (Pers.) Cke. which it closely resembles it may be distinguished by its dry pileus, adnate lamellae and solid stem. Found but once.

## Russula albida Pk.

WHITISH RUSSULA

State Mus. Bul. 2. 1887. p. 10; State Mus. Bul. 105. 1906. p. 38, pl. 96, fig. 1-7.

Pileus thin, fragile, hemispheric or very convex becoming nearly plane or slightly depressed in the center, slightly viscid when moist, white, often tinged with yellow in the center, even or slightly striate on the margin, flesh white, taste mild or slightly and tardily bitterish and unpleasant; lamellae thin, moderately close, entire, occasionally forked at the base, adnate or subdecurrent, white or whitish, the interspaces often venose; stem equal or slightly tapering upward, glabrous, stuffed or hollow, white; spores white or with a faint yellowish tinge, subglobose, .0003-.00035 of an inch long, nearly or quite as broad.

Pileus 1-2 inches broad; stem 1-3 inches long, 3-5 lines thick.

Among fallen leaves in woods. Rensselaer and Suffolk counties. July and August. Edible.

The slowly developed unpleasant taste of the fresh plant is lost in cooking. The thin margin of the cap is sometimes curved upward in old plants. Distinguished from R. lactea Fr., which it resembles in color, by its separable, slightly viscid pellicle, its adnate or subdecurrent closer lamellae and its stuffed or hollow stem. By the adnate lamellae and mild taste it may be distinguished from whitened forms of R. emetica Fr.

## Russula albella Pk.

SLIGHTLY WHITE RUSSULA

State Mus. Rep't 50. p. 101.

Pileus thin, fragile, dry, plane or slightly depressed in the center, even or obscurely striate on the margin, white or whitish, sometimes tinged with pink or rose-red, specially on the margin, flesh white, taste mild; lamellae thin, close, equal, white; stem equal, solid or spongy within, white; spores white globose, .0003 of an inch broad.

Pileus 2-3 inches broad; stem 1-2 inches long, 3-4 lines thick.

Dry soil in woods. Suffolk county. July. Rare.

This species, like R. anomala Pk. departs from the usual character of the species of this subgenus in having a dry pileus. The fragile pileus and equal lamellae, however, indicate its close

relationship to this subgenus. From R. lactea Fr. it differs in its fragile texture, equal lamellae and the surface of the pileus not cracking and forming areolae.

### Russula veternosa Fr.

LANGUISHING RUSSULA

Pileus convex becoming plane or centrally depressed, covered with a slightly viscid adnate pellicle, even on the margin, red or flesh-colored, typically becoming whitish or yellowish in the center, flesh white, taste acrid; lamellae narrow, broader in front, close, adnate, a few shorter ones intermingled, white becoming yellowish; stem equal, even, fragile, soft, spongy within becoming hollow, white; spores pale yellow, subglobose, .0003–.00035 of an inch long, nearly as broad.

Pileus 2–3 inches broad; stem 2–3 inches long, 5–8 lines thick.

Thin woods. Saratoga county. August. Rare.

In our specimens the pileus is in some cases a little paler in the center than on the margin, but none of them is centrally whitish or yellowish as in the typical form. The red pileus with even margin, the acrid taste and pale yellow spores are distinguishing characters in this species.

### Russula integra (L.) Fr.

ENTIRE RUSSULA

Pileus firm, becoming fragile, convex becoming plane or centrally depressed, covered with a viscid separable pellicle, thin on the margin which is at length coarsely tuberculose striate, variable in color, flesh white, taste mild; lamellae broad, nearly free, equal, distant, white becoming pale yellow, dusted by the spores; stem at first short, conic, becoming clavate, even, ventricose, sometimes cylindric, spongy within, white; spores pale yellow, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 3–5 inches broad; stem 1.5–2.5 inches long, 6–12 lines thick.

Woods. Adirondack region. July and August. Rare.

The specimens which we have referred to this species are dark red and do not always have the margin distinctly tuberculose striate. The stem is cylindric or sometimes thickened toward the base.

Var. rubrotincta Pk. Stem tinged with red. Otherwise as in the typical form.

### Russula palustris Pk.

SWAMP RUSSULA

State Mus. Rep't 53. 1900. p. 842.

Pileus thin, fragile, subglobose or hemispheric becoming convex or nearly plane, viscid when moist and covered with a separable pellicle, obscurely tuberculose striate on the margin, reddish buff to purplish red, flesh white, tinged with reddish buff under the pellicle, taste tardily acrid; lamellae entire, moderately close, whitish becoming yellowish, interspaces venose; stem equal, glabrous, spongy within or hollow, fragile, white or tinged with red; spores pale yellow, subglobose, .0003–.0004 of an inch long, uninucleate.

Pileus 2–3 inches broad; stem 1.5–3 inches long, 4–6 lines thick.

Swamps, under alders. St Lawrence county. August. Rare.

Related to R. decolorans Fr. but smaller, thinner, more fragile, tardily acrid and not discoloring or assuming cinereous hues with age.

### Russula decolorans Fr.

DISCOLORED RUSSULA

Pileus fleshy, firm, globose becoming plane or centrally depressed, slightly viscid when moist, polished, even on the margin, becoming striate with age, orange-red becoming paler with age, flesh white, becoming cinereous and variegated with black spots when broken, taste mild; lamellae thin, close, adnexed, fragile, sometimes forked at the base, white becoming yellowish; stem long, cylindric, solid or spongy within, white becoming cinereous, specially within; spores subglobose, yellowish, .0003–.0004 of an inch long, nearly as broad.

Pileus 2–4 inches broad; stem 2–4 inches long, 5–10 lines thick.

Woods. July to October. Not rare.

### Russula obscura Rom.

OBSCURE RUSSULA

Pileus fleshy, convex becoming nearly plane, even on the margin or only slightly striate when old, dark red or purple sometimes blackish in the center, not becoming paler with age, subpruinose on the margin; lamellae, spores, size and stem as in R. decolorans.

Albany, Rensselaer and Suffolk counties. July and August.

The chief difference between this species and R. decolorans is found in the color of the pileus. This is variable but darker than in the typical form of that species and more persistent. The flesh and stem become cinereous or smoky brown.

**Russula constans** Karst.

CONSTANT RUSSULA

Pileus fleshy, convex becoming plane or nearly so, even or unequally striate on the margin, viscid, pale yellow, flesh white becoming gray with age; lamellae adnexed, whitish or pale yellow, becoming smoky brown or blackish in drying; stem white becoming ashy gray with age; spores, size of plant etc. as in R. decolorans Fr.

Woods. Adirondack region. August and September.

This and R. obscura agree with R. decolorans in their general characters, the most conspicuous difference between them and it being the color of the pileus. This character in many species is not thought to be of specific value, but in these plants the colors of the pilei appear to be constant, nor do they become intermingled on the same pileus as in other species with the pileus variously colored.

**Russula puellaris** Fr.

YOUTHFUL RUSSULA

Pileus thin, conic or convex becoming plane or slightly depressed, scarcely viscid, tuberculose striate on the margin, variable in color, livid, purplish or yellowish, darker or brownish in the center, flesh white, taste mild; lamellae thin, close, narrowed toward the stem, adnate, white becoming pale yellow; stem equal, soft, fragile, stuffed or hollow, white or yellowish; spores pale yellow, subglobose, .0004 of an inch long, .0003 broad.

Pileus 1–1.5 inches broad; stem 1–1.5 inches long, 2–4 lines thick.

Woods. Albany county. July. Rare.

Var. intensior Cke. Pileus deep purple, nearly black in the center, otherwise as in the typical form. Our specimens belong to this variety. The stem is white and shows no yellowish spots or stains.

**Russula pusilla** Pk.

SMALL RUSSULA

State Mus. Rep't 50. 1897. p. 99.

Pileus very thin, nearly plane or slightly and umbilicately depressed in the center, glabrous, slightly striate on the margin, the thin pellicle separable, red, sometimes a little darker in the center, flesh white, taste mild; lamellae broad, subventricose, subdistant, adnate, or slightly rounded behind, white becoming yellowish ochraceous with age or in drying; stem short, soft, solid or spongy within, white; spores yellowish, globose, .0003 of an inch broad.

Pileus scarcely 1 inch broad; stem 6–12 lines long, 2–3 lines thick.

Naked ground in woods. Suffolk county. July. Rare.

This is the smallest russula known to me. The coloring matter of the pileus produces red stains on moist paper when the pileus is rubbed over the paper.

### **Russula flaviceps** Pk.

YELLOW CAP RUSSULA

State Mus. Rep't 53. 1900. p. 843.

Pileus convex or centrally depressed, glabrous, covered with a thin viscid separable pellicle, even on the margin when young, slightly tuberculose striate when old, pale yellow, flesh white, taste mild or slightly acrid; lamellae close, narrow, adnate or slightly rounded behind, pale yellow becoming more yellow and dusted by the spores with age; stem equal or nearly so, stuffed or spongy within, white; spores yellow, subglobose, .0003 of an inch long.

Pileus 2–4 inches broad; stem 1.5–2.5 inches long, 4–8 lines thick.

Woods. Sullivan county. August. Rare.

Distinguished from R. citrina Gill. and R. fingibilis Britz. by its yellow lamellae, and from R. lutea Fr. by its striate margin and paler yellow lamellae and spores.

### **Russula lutea** (Huds.) Fr.

YELLOW RUSSULA

Pileus thin, rather firm, convex becoming plane or centrally depressed, viscid when moist, even on the margin, beautifully yellow becoming paler with age, flesh white, taste mild; lamellae narrow, close, free, equal, bright ochraceous; stem equal or tapering upward, soft, stuffed or hollow, white; spores yellow, globose or subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods. Essex county. August. Rare. This pretty species has been found by me but once.

### **Russula roseipes** (Secr.) Bres.

ROSY STEM RUSSULA

Pileus thin, convex becoming plane or slightly depressed in the center, slightly viscid, soon dry, slightly striate on the thin margin, reddish flesh color, rosy red or rosy orange, flesh white or yellowish, taste mild; lamellae equal, close, sometimes forked near the stem, free or adnexed, with a decurrent tooth, whitish becoming yellow; stem equal or tapering upward, stuffed or cavernous, reddish or

white stained with red; spores globose, pale ochraceous, .0003–.0004 of an inch long.

Pileus 1–1.5 inches broad; stem 1–2 inches long, 3–5 lines thick.

Woods. Albany and Saratoga counties. July.

This is by some considered a variety of R. puellaris Fr. The red color of the stem when viewed under a lens is seen to be due to minute red particles or a rosy mealiness.

### **Russula abietina** Pk.

FIR TREE RUSSULA

State Mus. Rep't 54. 1901. p. 180, pl. 7, fig. 1–11.

Pileus thin, fragile, convex becoming plane or slightly depressed in the center, covered with a viscid separable pellicle, tuberculose striate on the thin margin, variable in color, purplish, greenish purple or olive-green with a brown or blackish center, or sometimes purplish with a greenish center, flesh white, taste mild; lamellae narrowed toward the stem, subdistant, equal, rounded behind and nearly free, ventricose, whitish becoming pale yellow; stem equal or tapering upward, stuffed or hollow, white; spores bright yellowish ochraceous, subglobose, .0003–.0004 of an inch long, nearly or quite as broad.

Pileus 1–2.5 inches broad; stem 1–2.5 inches long, 3–5 lines thick.

Under balsam fir trees. Essex county. July and August. Edible.

The species is closely related to R. turci Bres. from which I have separated it because of its paler lamellae and the absence of cystidia from the lamellae and of minute areolae from the pileus and because of the presence of greenish and olive-green colors in the pileus. Its place of growth is only under balsam fir trees, Abies balsamea (L.) Mill., so far as it has been observed.

### **Russula turci** Bres.

TURC RUSSULA

Pileus fleshy, thin, convex becoming plane or centrally depressed, viscid, striate on the margin when mature, reddish violaceous or lilac-purple, darker or blackish in the center, sometimes becoming yellowish in age and minutely areolate, flesh white or whitish, taste mild; lamellae equal, subclose, rounded behind, free, pallid when young, soon ochraceous, interspaces venose; stem equal or tapering upwards, rugulose, soon cavernous or hollow, fragile, white; spores ochraceous, globose, echinulate, .0003–.00035 of an inch in diameter.

Pileus 1.5–3 inches broad; stem 1.5–3 inches long, 3–6 lines thick.

Gregarious; in pine woods. Albany county. October.

The specimens referred to this species were formerly thought to belong to Russula nitida (Pers.) Fr. but they agree much more closely with the description of this more recently described russula, from which they can scarcely be specifically distinct. The plant differs from R. nitida in having no well marked odor and in having neither the pileus nor the lamellae shining. Cystidia are present but they are slightly shorter than in the typical form of R. turci.

### Russula chamaeleontina Fr.

CHAMELEON RUSSULA

Pileus thin, fragile, plane or slightly depressed in the center, covered with a viscid separable pellicle, even on the margin when young, becoming slightly striate with age, variable in color, pinkish or rose-red, purplish or lilac, becoming yellow in the center or wholly yellowish, flesh white, taste mild; lamellae thin, close, narrow, adnexed or free, sometimes forked, yellow; stem slender, slightly striate, somewhat hollow, white; spores ochraceous, globose, .0003 of an inch broad.

Pileus 1–2 inches broad; stem 1–2 inches long, 2–3 lines thick.

Woods. Saratoga and Albany counties. July and August.

### Russula alutacea Fr.

TAN COLORED RUSSULA

Pileus fleshy, convex becoming plane or centrally depressed, covered with a viscid pellicle, even on the margin when young, becoming more or less tuberculose striate when old, variable in color, red, bright blood-red, dark purple, olivaceous or green, flesh white, taste mild; lamellae thick, broad, equal, subdistant, rounded behind, pale yellow becoming ochraceous tinged with tan color, naked, stem stout, solid, spongy within, even, white or red; spores ochraceous yellow, subglobose, .0003–.0005 of an inch long, .0003–.0004 broad.

Pileus 2–4 inches broad; stem 1–2.5 inches long, 6–12 lines thick.

Woods and groves. July and August. Common.

A large fine species considered edible but I have not tried it. The color of the pileus is so variable that the species is not always readily recognized. From R. integra, which is also variable in the color of the pileus, it may be separated by the naked lamellae and the ochraceous color of the spores.

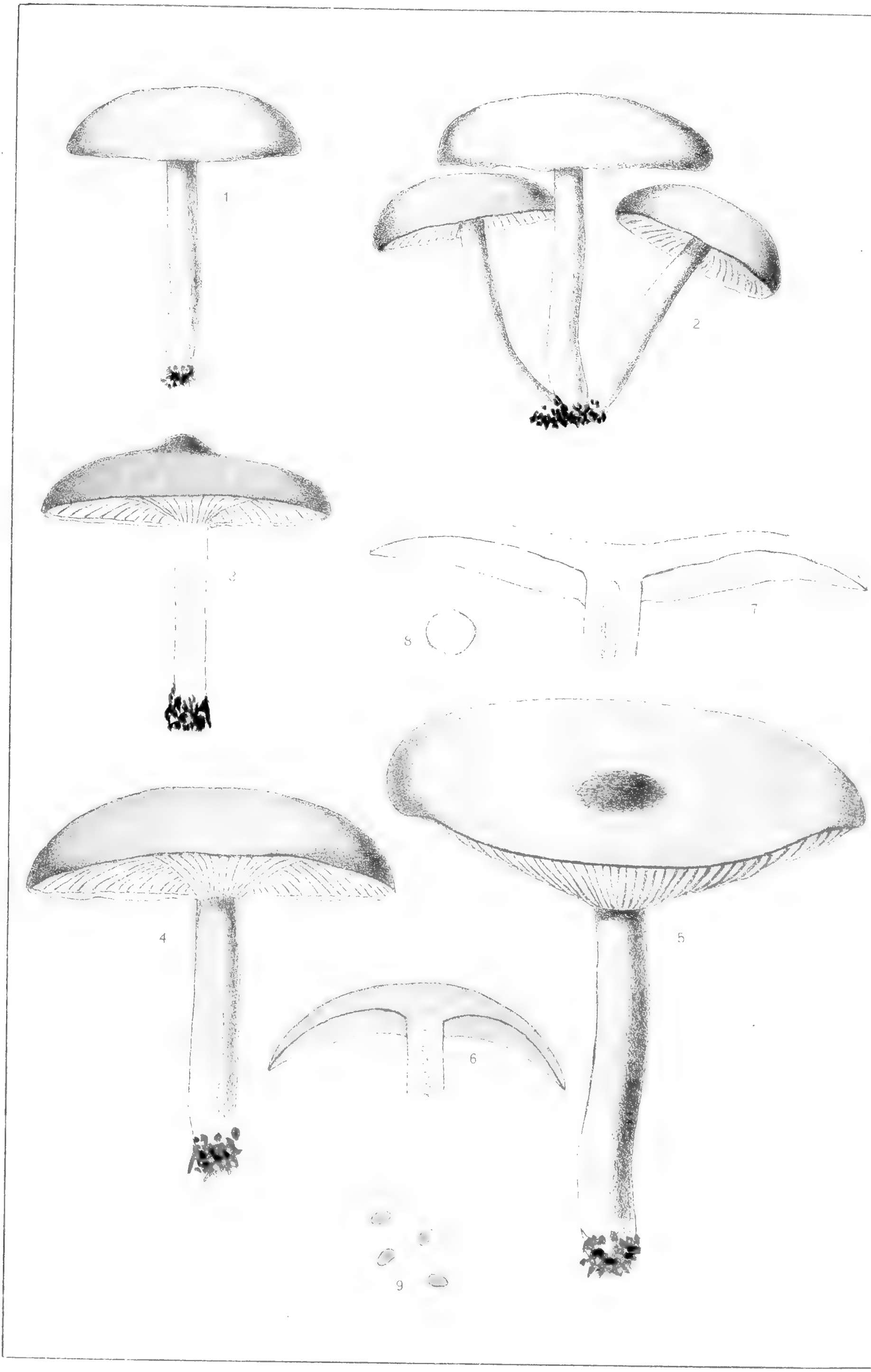
# EXPLANATION OF PLATES

## PLATE 104

## **Tricholoma nudum** (Bull.) Fr.

NAKED TRICHOLOMA

1 Young plant
2 Cluster of three young plants
3 Young plant with umbonate cap
4 Mature plant with convex cap
5 Mature plant with plane cap
6 Vertical section of young cap and upper part of stem
7 Vertical section of mature cap and upper part of stem
8 Transverse section of a stem
9 Four spores, x 400




TRICHOLOMA NUDUM (BULL.) FR.
NAKED TRICHOLOMA

PLATE 105

**Tricholoma hirtellum** Pk.

HAIRY CAP TRICHOLOMA

1 Cluster of three plants
2 Single plant
3 Vertical section of cap and upper part of stem
4 Transverse section of stem
5 Four spores, x 400

**Russula pectinatoides** Pk.

PECTENLIKE RUSSULA

6 Plant with convex cap
7, 8 Two plants with caps fully expanded
9 Vertical section of cap and upper part of stem
10 Four spores, x 400

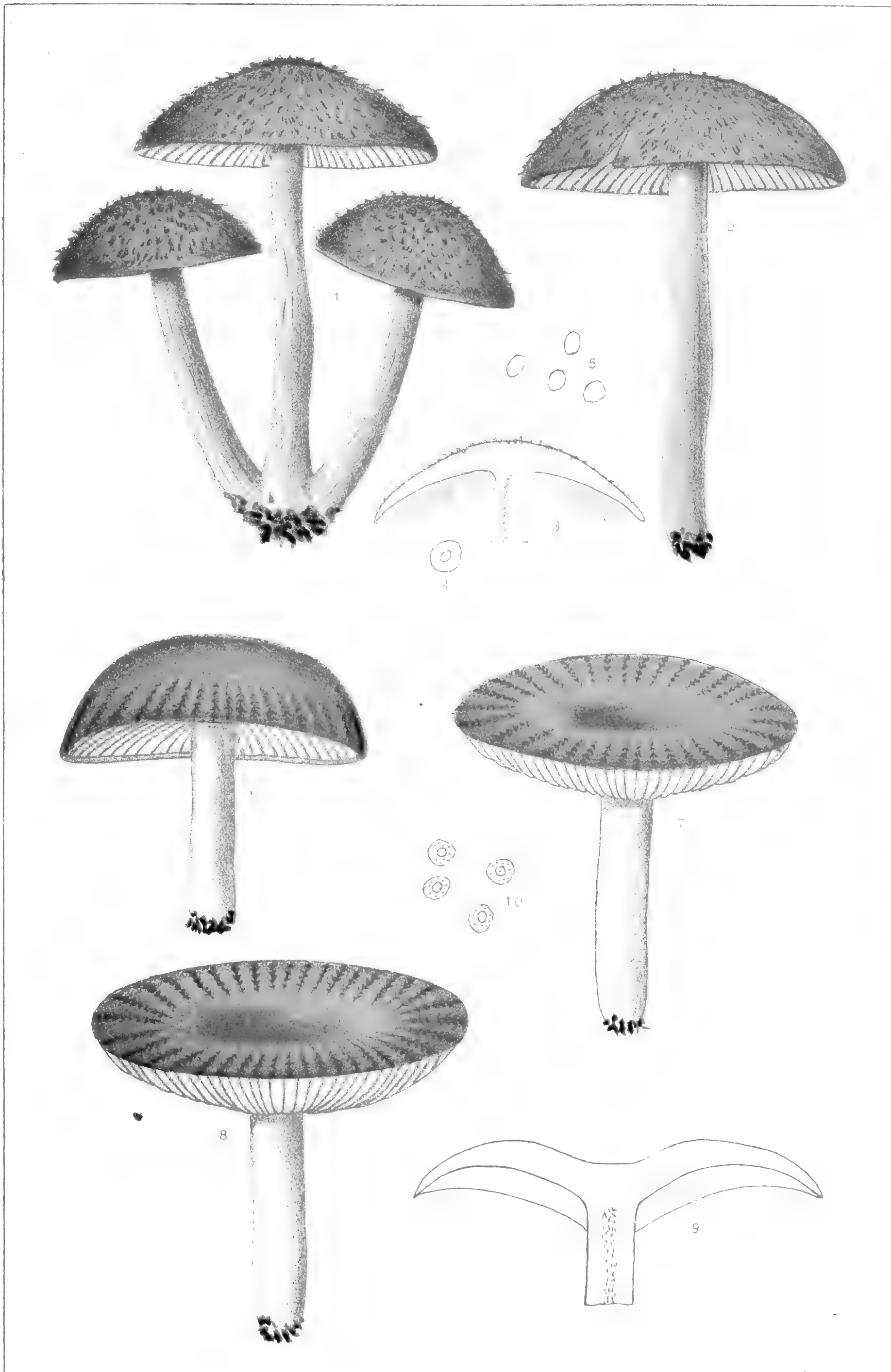



FIG. 1–5.
TRICHOLOMA HIRTELLUM PK.
HAIRY CAP TRICHOLOMA

FIG. 6–10.
RUSSULA PECTINATOIDES PK.
PECTENLIKE RUSSULA

PLATE 106

## **Agaricus micromegethus** Pk.

SMALL MUSHROOM

1 Small plant
2 Plant of medium size showing color of young gills
3 Cluster of three plants, two of them large
4 Vertical section of young cap and upper part of stem
5 Vertical section of mature cap and upper part of stem
6 Four spores, x 400

## **Russula uncialis** Pk.

INCH WIDE RUSSULA

7, 8 Two young plants with convex caps
9 Mature plant with expanded cap
10 Vertical section of young cap and upper part of stem
11 Vertical section of mature cap and upper part of stem
12 Four spores, x 400


FIG. 1–6.
CLITOCYBE AMETHYSTINA (BOLT.)
AMETHYST CLITOCYBE

FIG. 7–11.
CLITOCYBE OCHROPURPUREA BERK.
PURPLE GILLED CLITOCYBE

PLATE 108

**Agaricus micromegethus** Pk.

SMALL MUSHROOM

1 Small plant
2 Plant of medium size showing color of young gills
3 Cluster of three plants, two of them large
4 Vertical section of young cap and upper part of stem
5 Vertical section of mature cap and upper part of stem
6 Four spores, x 400

**Russula uncialis** Pk.

INCH WIDE RUSSULA

7, 8 Two young plants with convex caps
9 Mature plant with expanded cap
10 Vertical section of young cap and upper part of stem
11 Vertical section of mature cap and upper part of stem
12 Four spores, x 400

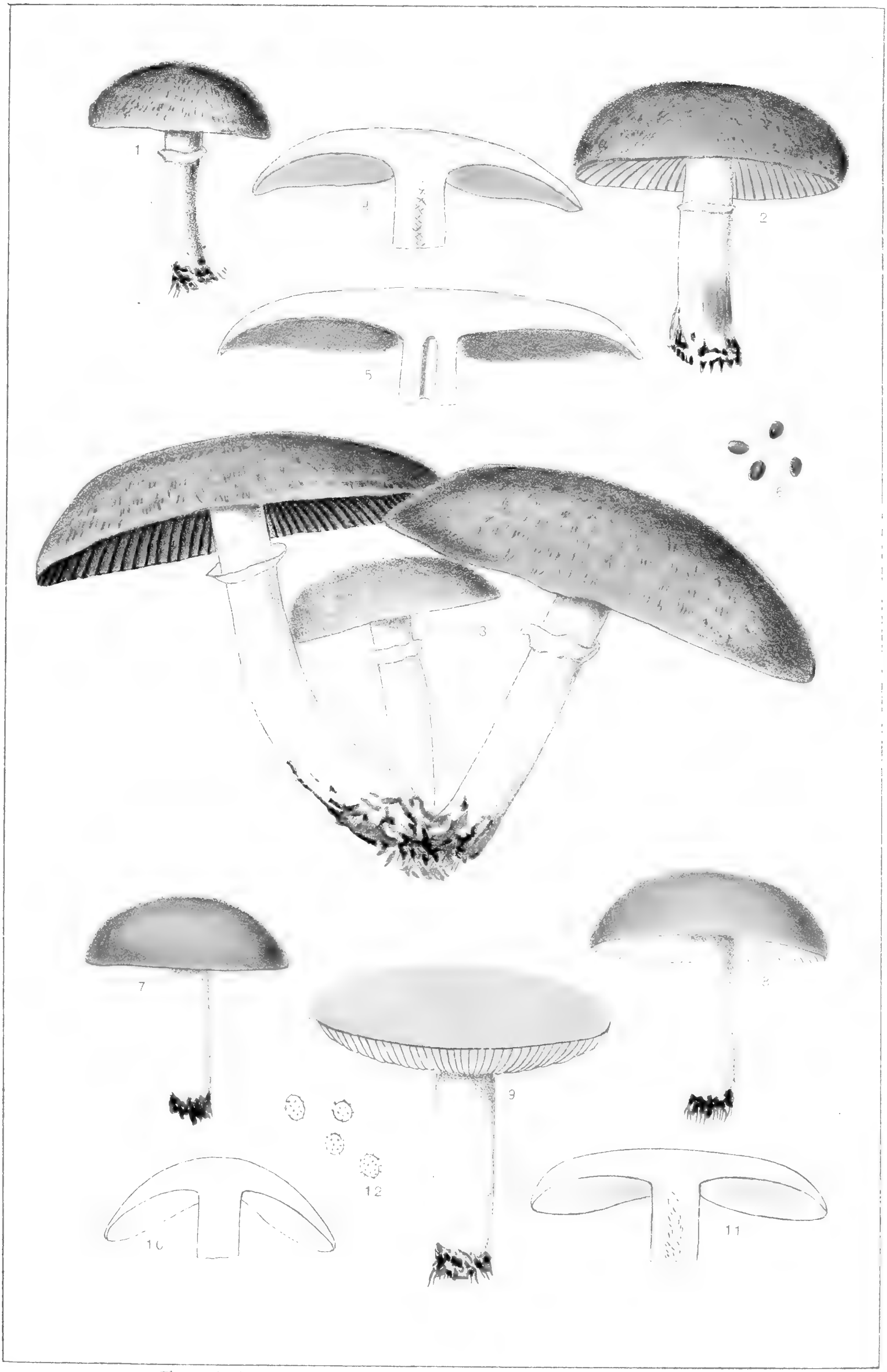



FIG. 1-6.
AGARICUS MICROMEGETHUS PK.
SMALL MUSHROOM

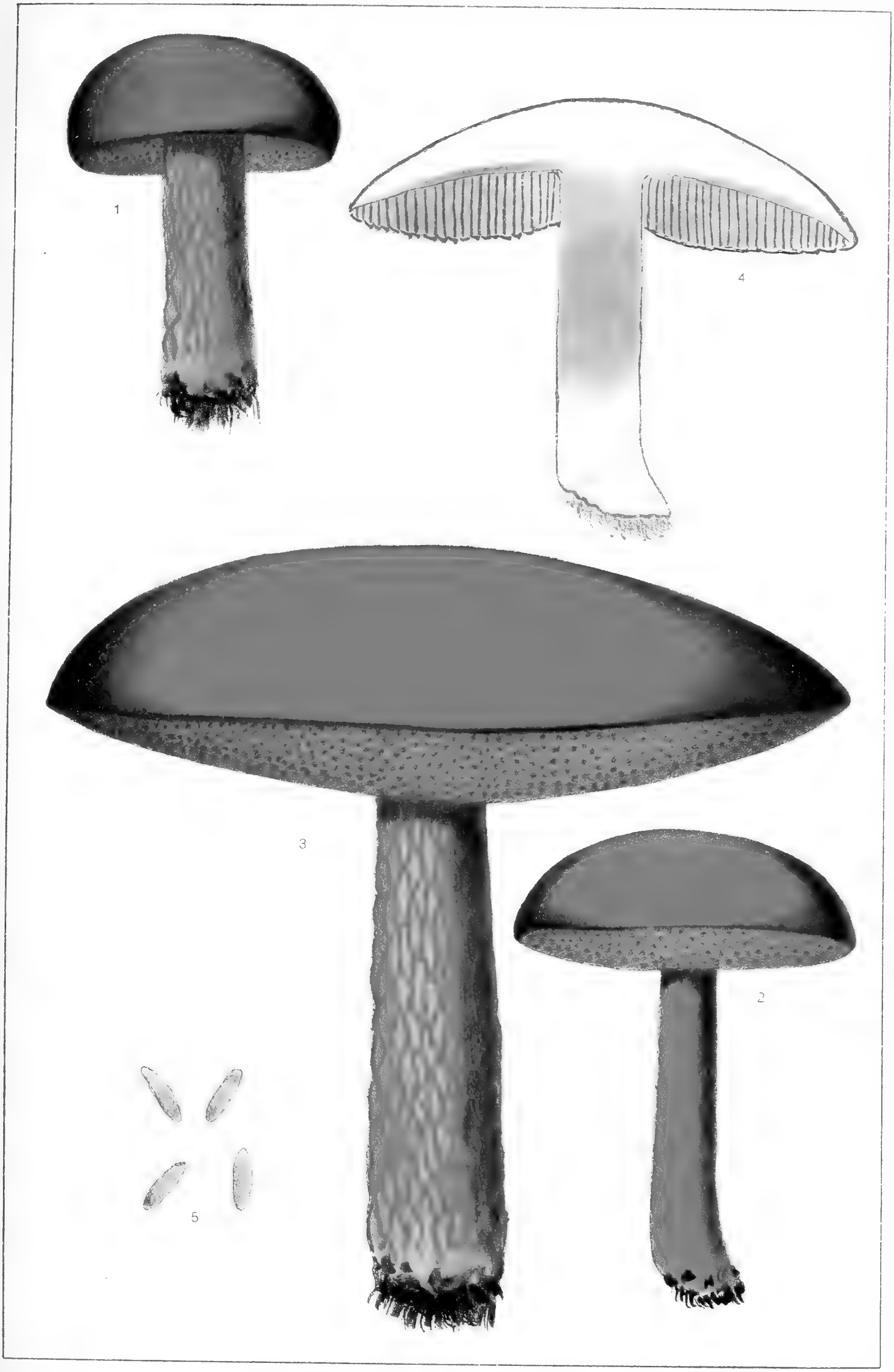
FIG. 7-12.
RUSSULA UNCIALIS PK.
INCH-WIDE RUSSULA

PLATE 108

**Boletus frostii** Russ.

FROST BOLETUS

1 Young plant
2 Small mature plant
3 Mature plant of medium size
4 Vertical section of cap and stem
5 Four spores, x 400




BOLETUS FROSTII Russ.
FROST BOLETUS

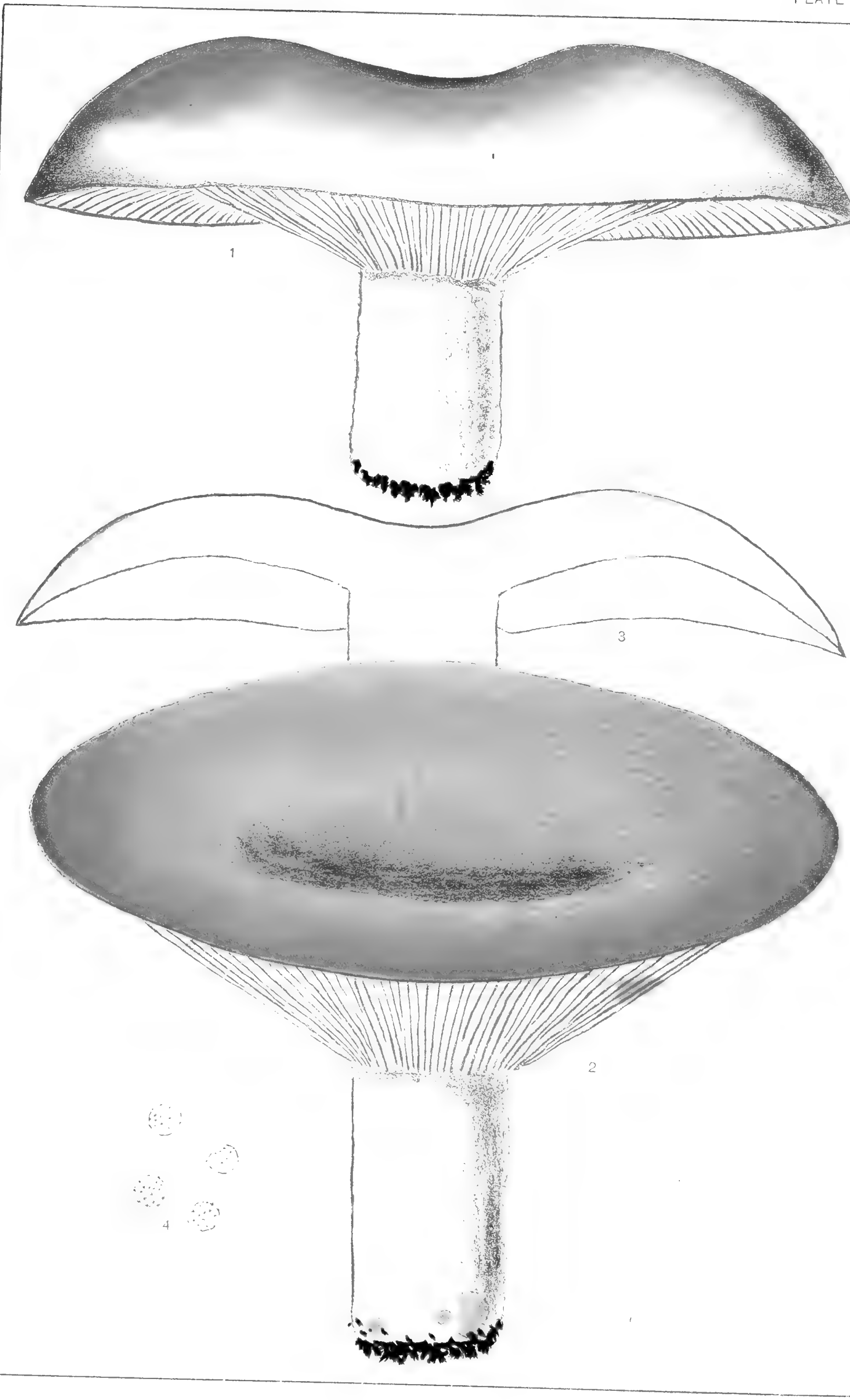
PLATE 109

109

**Russula compacta** Frost

COMPACT RUSSULA

1 Young plant with convex cap with whitish margin
2 Mature plant with expanded centrally depressed cap
3 Vertical section of cap and upper part of stem
4 Four spores, x 400




RUSSULA COMPACTA Frost.

COMPACT RUSSULA

# INDEX

MUSEUM BULLETIN 114

## Geologic map of the Rochester and Ontario Beach quadrangles

MUSEUM BULLETIN 118

## Geologic map of the Portage and Nunda quadrangles and map of Letchworth Park

EDUCATION DEPARTMENT
JOHN M. CLARKE
STATE GEOLOGIST

UNIVERSITY OF THE STATE OF NEW YORK
STATE MUSEUM

BULLETIN 114
ROCHESTER AND ONTARIO BEACH QUADRANGLES


LEGEND
UPPER SILURIC

MEDINA
Lower Medina (shales)
Upper Medina (sandstones and shales)

CLINTON
Sodus shale
Furnaceville ore
Wolcott limestone
Williamson shale
Irondequoit limestone

NIAGARA
Rochester shale
Lockport dolomite
Lockport dolomite with Guelph fauna

SALINA

Topography by U. S. Geological Survey
in co-operation with the State of New York

Geology by C. A. Hartnagel

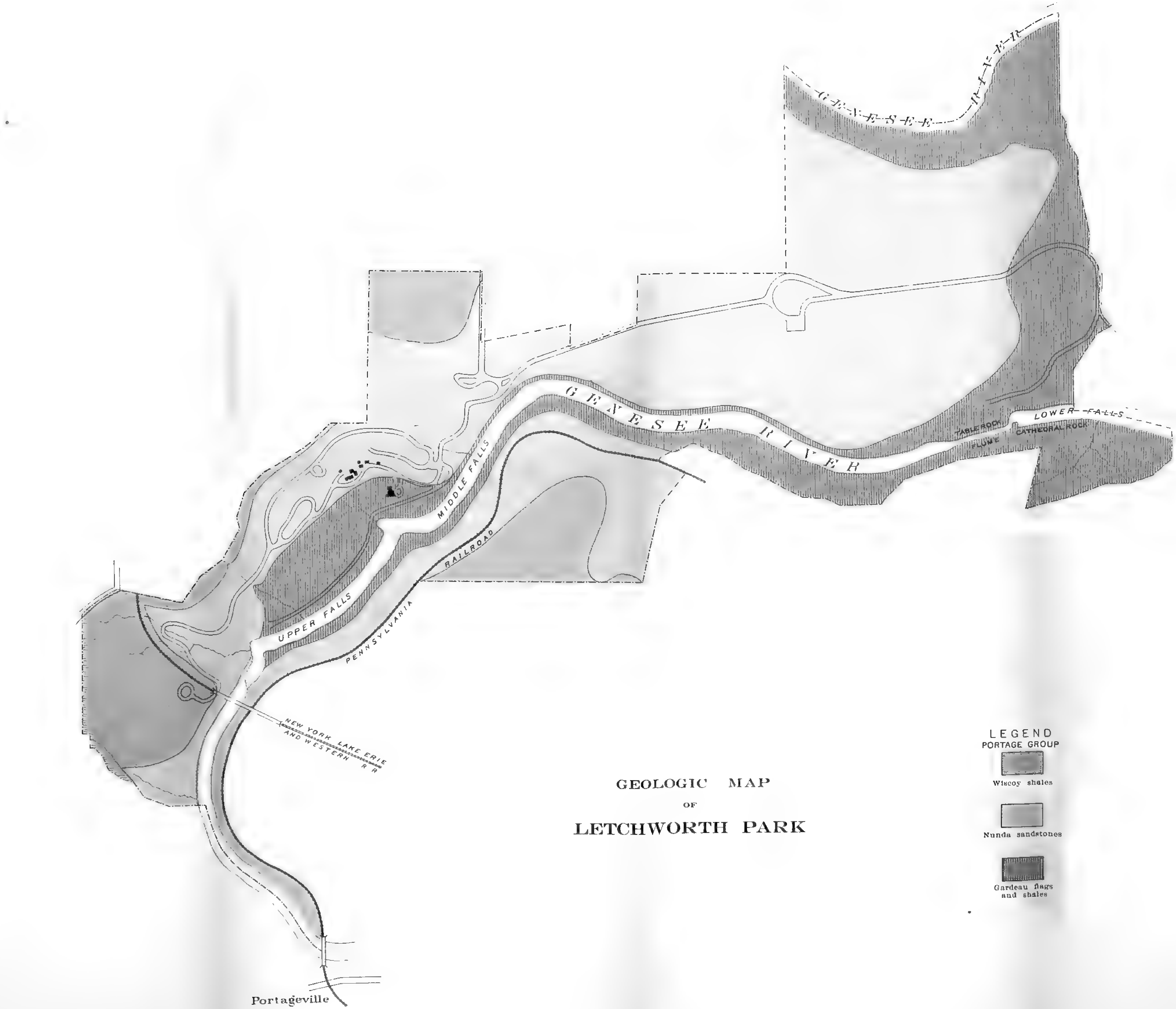

GENESEE RIVER
GENESEE RIVER
MIDDLE FALLS
UPPER FALLS
PENNSYLVANIA RAILROAD
NEW YORK LAKE ERIE AND WESTERN R.R.
TABLE ROCK
LOWER FALLS
FLUME
CATHEDRAL ROCK
Portageville
GEOLOGIC MAP
OF
LETCHWORTH PARK
LEGEND
PORTAGE GROUP
Wiscoy shales
Nunda sandstones
Gardeau flags and shales


DIAGRAM SHOWING ROCK SECTION EXPOSED ON NUNDA AND PORTAGE QUADRANGLES IN THE GENESEE RIVER VALLEY

VERTICAL SCALE 1 INCH = 1000 FEET

HORIZONTAL " 1 " = 1 MILE


LEGEND

Chemung shales and sandstones

Wiscoy shales

Nunda sandstones

Gardeau flags and shales

Grimes sandstones

Hatch shales and flags

Rhinestreet black shale

Cashaqua shale

Middlesex black shale

West River shale

Genundewa limestone

Genesee black shale

Alluvium

Geology by D. D. Luther.

Scale $\frac{1}{62500}$

Miles

Kilometers

Contour interval 20 feet.

Datum is mean sea level